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TENTH ANNUAL REPORT
OF THE DIRECTOR OF
THE BUREAU OF SCIENCE

TO THE HONORABLE
THE SECRETARY OF THE INTERIOR

BY
PAUL C. FREER
DIRECTOR OF THE BUREAU OF SCIENCE

FOR THE YEAR ENDING AUGUST 1, 1911



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TENTH ANNUAL REPORT OF THE DIRECTOR OF THE BUREAU OF SCIENCE.

DEPARTMENT OF THE INTERIOR,
BUREAU OF SCIENCE,
Manila, August 1, 1911.

SIR: The Bureau of Government Laboratories was established on July 1, 1901, by Act number 156 of the Philippine Commission. Therefore it has completed the tenth year of its official existence, although actual work was not begun until September 25 of the same year.

New buildings.—The new wing of the laboratory building to contain the division of mines, the section of fisheries and fish products, the entomological collections and laboratories, the section of ornithology, and the library, is approaching completion. The division of mines will have 4 well-equipped work rooms for its staff, a large exhibition room containing both glass-top cases and cabinets, a room for draughtsmen, one for machinery for cutting rock sections and grinding petrographic slides and a special space for petrographic work. The room set apart for fisheries will contain work tables for 8 biologists; it will be equipped with 5 experimental aquaria, as well as hatching jars, museum cases, and net lockers. The section for entomology will have 3 laboratory rooms with space for 6 workers and a special apartment for the collections. The latter will be placed in Schmidt cases of the most modern type. The library will be given a reading room, a charging desk, a work room for the librarian, a separate work room for the assistants, and the books will be shelved on a double tier of stacks capable of accommodating 90,000 volumes. The section devoted to ornithology has space for 2 workers and ample room for the filing of the collections.

The herbarium of the Bureau will be moved into the present library rooms as soon as possible and all of the ground floor of the laboratory, which has been occupied by the sections of the biological laboratory devoted to botany, entomology, and ichthyology, will be cleared for the use of the bacteriologists and pathologists. The transfer of the division of mines to the new wing will give the chemical laboratory 2 additional rooms and the Bureau much needed office space. As soon as the move has taken place, the rooms of the present laboratory structure will be altered to meet the new requirements. This will not involve any serious

changes because the plumbing and fixtures were blocked in at the beginning, with this plan in view, so practically all that need be installed will be the necessary workers' desks. The construction of this wing is in conformity with the original plan of the laboratory building.

I desire once more to emphasize the fundamental necessity of enlarged accommodations for the laboratories devoted to the tests of cement, concrete, road materials, rope, wire, steel, cloth, and other similar materials. All of the road-testing apparatus arrived during the past year and therefore the condition, which was emphasized in the last annual report, has been aggravated. There are scarcely 18 inches between the various pieces of apparatus and much of it is mounted outside of the present building and under the eaves of the various outhouses. The large testing machine, at present the property of the Bureau of Forestry, is still located at Bilibid Prison and it can not be transferred until a proper building is provided. As the testing laboratory has finally taken over all of the Government work on cement and as the demand for purchase under specifications is increasing steadily, it will be seen that the task of going across the city to Bilibid Prison in order to use this machine is becoming more and more onerous. It may again be stated that the saving resulting from complete cement and concrete tests on one or two structures alone, if those structures are of any magnitude, will more than compensate for the cost of this laboratory. It is sincerely hoped that means can be provided, even before the meeting of the next Legislature, to begin the construction of this edifice. In considering everything, it seems advisable to build it as the beginning of the second wing of the laboratory proper.

A suggestion was made in the last annual report that a building devoted to assays and for experimental work on large quantities of ores should be constructed. At the present time, miners send their large samples to the United States for milling and cyaniding tests. Of course, this work could be done here if an adequate laboratory could be provided. The incorporation of such a laboratory with that for the testing of cements and concretes would involve a structure of considerable size and perhaps in the end it would be more economical to build both at the same time. However, it is feasible to begin with the laboratory for the testing of cements and other materials, and to construct the other as a separate project.

The aquarium.—During the year the sum of ₱40,000 was transferred to the Bureau of Science by the Governor-General from funds under the control of the Secretary of Commerce and Police for the building of an aquarium, which is now being constructed in the bastion immediately in front of the Real Gate of the city walls. The aquarium is in the form of a tunnel, with the exhibit tanks on the inner wall. Light is admitted from the opposite side. The roof of the structure will form

a garden which will serve as a promenade. There are 26 tanks of the regular size, and 1 large one, and 3 ponds, partly without and partly within the aquarium proper, to serve for larger fish and marine animals. All the aquaria in the world, with the exception of that in the City of Berlin, so far as I am aware, have immediate access to sea water, and do their pumping directly from that portion of the ocean lying adjacent. Many of these aquaria can use practically clear water; others are provided with expensive systems of settling tanks and filters. The waters of the Harbor of Manila are not clean enough to be used directly, consequently we will have to depend upon water which is hauled from a distance and which is in a closed system. An adequate pumping and filtering system is provided. We expect to experience some difficulty, which will probably be overcome in time, both with the water and with the food of the fishes. The plans of the aquarium were made by the Consulting Architect following sketches prepared in this Bureau by the ichthyologist. After the construction work was well under way, the Director of the Bureau received a monograph on the aquaria of the world written by Charles Atwood Kofoed. It was gratifying to note that our plans were practically in accord with the approved practice in other institutions, although it is evident that most of them use a thicker glass than we have installed. It is hoped that we will not have serious trouble with the cracking of the glass.

The Bureau has had no funds provided for operating this aquarium and will be forced to depend upon the income received from admission fees. What this income will be, no one can foretell. However, the work will be undertaken and after a few months we will have some definite assurance as to the result.

The Iloilo sugar laboratory.—The laboratory at Iloilo, established for the purpose of polarizing sugars, has this year shown a very marked increase in the amount of work brought to it. The chemist in charge has not only been called upon to do more than 2,000 polarizations from December 13 to the end of July, but he also has frequently been consulted in regard to sugar properties, as well as concerning the planting of cane and other necessities of the situation. He has started experimental plats of cane at the San Carlos sugar estate of the Compañía General de Tabacos de Filipinas and to carry on this work simultaneously with that of the Iloilo laboratory was almost impossible. An assistant was sent to him during part of the year. The increased use of this laboratory is very gratifying and brings us face to face with the necessity of making a radical enlargement of the Iloilo plant. It seems evident that sugar will in a few years be the most important export product of the Philippine Islands, yet we have only a small laboratory in a rented building with one chemist on duty all of the time to provide for the needs of this growing industry. It is imperatively

necessary, now that the sugar growers and merchants are coming to us, to give them increased facilities and to be able to send men into the field to inspect haciendas, to give advice in the raising of the cane and the extraction of the juice, to analyze the soils, and in every way to encourage the industry in the same way as it has been done in other sugar-growing countries. Seventy-five per cent of this work is laboratory work; that is, cane of various varieties and ages must be analyzed, soils must be surveyed, sugar polarized, processes of boiling supervised and improved, and other lines of investigation undertaken which require chemical work. The trained laboratory man also is able better to cover the question of the best results to be obtained from various varieties of cane than anyone else. Therefore, we need two assistant chemists in addition to the head chemist in charge. The Iloilo laboratory should be made into a division and an additional sum of ₱15,000 per year appropriated to its use.

Soil surveys.—The Philippines is fundamentally an agricultural country. We have given much attention to the industrial development of mines and mining, and to the hygienic features and measures necessary for the prosperity of the country, and, since the organization of the Bureau, from time to time have done a considerable number of the analyses of soils for the Bureau of Agriculture, the Bureau of Education, and for private persons. Finally this mass of data has grown to such proportions that we can begin to obtain a fairly comprehensive view of the subject and of the necessity for its development.

The Philippine soils as a whole are fairly rich. Those which have been cultivated are perhaps better adapted to crops than those of the wild and uncultivated lands, but the nature of the crops to be raised is dependent upon many other features besides that of the chemical composition of the soils. The Bureau has made some progress in physical analyses and has developed feasible methods to be used in the laboratory, and by as careful a study as possible of the weather reports from the various regions of the Islands, the chief of the division of inorganic and physical chemistry has been able to make a tentative classification of the districts best adapted to certain crops. The results of this work give us a preliminary view of what might be accomplished if the matter could be taken up in earnest.

Consideration of the subject of the chemical analyses of soils extending over a number of years, also, has brought the conviction that this feature of soil examination is not of as great a value as it is supposed to be. Almost any soil excepting one of an extremely remarkable character, contains the constituents necessary for the growth of plants. The inorganic materials which form the plants' food must be in solution when used by the plant and they go into solution because of the action of water, first upon the finer and then upon the coarser particles of the

soil. Any soil subject to the action of water is, therefore, undergoing constant change. The coarser particles contained in a soil are closely related to the geologic formation of a given district. It is now possible by using the improved petrographic microscope to make a fairly accurate analysis of a fresh rock without using chemical means. The method occupies only about one-half the time necessary for a chemical analysis. As residual soils are intimately related to the rocks beneath them, and as the alteration in the latter have been worked out for all rock-forming minerals, it seems evident that a geological examination of a given region, combined with a mechanical analysis of the soils and a study of the rainfall and of the water courses, will have more bearing on the understanding of the specific crops adapted to the district than any number of chemical analyses. This is especially true of the Philippines where we encounter virgin soils and where the geology of the country is undergoing rapid change. As a rule, in the Philippines, the coastal plains and intermontane valleys are not extensive. The mountains are rapidly disintegrating owing to the heavy rains; therefore, the relationship between the soil and the geological formation should be the object of careful study. The importance of the relation of geology to soils is so well recognized in Europe that a distinct science has grown up, dealing with this relationship and a journal, especially devoted to this subject, is being published.

It is recommended that a soil survey of the Philippine Islands in relation to the best crops to be grown in certain regions be taken up from this comprehensive standpoint. Work of this kind can not be done effectively without a number of men especially detailed for it and sufficient funds. At least two geologists and one chemist should devote themselves to this subject in the most important districts of the Islands. Naturally, in this connection topographic maps would be of the greatest value. It is hoped that if a plan of soil survey is considered at all, the whole question will be viewed from the broadest standpoint, and realizing that the geologist, the chemist, and the meteorologist are the most important factors in the work.

Animal diseases.—I wish to renew my recommendation made in previous annual reports concerning the necessity in the Bureau of Science of a fund for the study of animal diseases. Human diseases have been given much careful attention in the last ten years. Much less has been done with those of animals. The Government has established a laboratory with extended facilities for pathological and bacteriological work. It has the nucleus of a staff of trained men which needs but little additional development to make productive work in animal diseases feasible. An appropriation has been available for the past year for the construction of a new stable for this purpose and there would seem to be no reason why the Government should not use

to the fullest extent the facilities which it has already provided, to carry on investigations in a larger field, especially as only a small additional appropriation, approximately ₦20,000, would enable us to accomplish much. The field is broad enough for all. The Bureau of Science has not the slightest intention of interfering in any way with the work in any other bureau or its development, but there are certain fundamental scientific investigations which ultimately might lead to great results and which can best be carried on in our larger laboratories. What we desire is that the Government make use of every opportunity it has at its command, and the greater the number of ways in which it can attack such an important problem, the greater will be the probability of ultimate success. I might even express a hope, although in a tentative way, that the modern methods of chemotherapy which of late have been so prominently brought to public attention by the researches of Ehrlich and his co-workers, may eventually give us a specific for rinderpest.

Tobacco insects.—During the past year the attention of the Bureau was repeatedly directed to the need of finding means of destroying the insects infesting the tobacco plant and the finished product of the factory. This Bureau has done what it could to begin such an investigation, but in order to carry it on properly, there should be at least two men continuously in the field in the chief tobacco-growing districts and one in the factories. The life histories of all insects which attack tobacco must be studied and the means of their eradication gradually developed. Such work is not very expensive, but at present, it is far beyond the means of the Bureau of Science for we have only two entomologists whom we can call upon for this class of work. It is hoped that a fund of ₦15,000 can be provided by the next Legislature for a careful study of this subject.

Plant pathology and plant physiology.—The Bureau, for many years, has planned to modify the composition of its staff of botanists. During the first ten years, it was necessary rapidly to build up the herbarium so as to have a proper basis upon which to conduct botanical work, for a herbarium bears exactly the same relation to the botanist as the library and the original documents do to the historian. However, once this herbarium is of adequate size and is properly classified, it is evident that we should begin to develop our botanical work along other lines as well. With this end in view, we have taken steps to engage a plant pathologist and a plant physiologist in place of two of our systematic botanists who have left, or are leaving, the Bureau. We will then have in the Bureau, as head of the work, a botanist of long experience in the Tropics; and, on the other hand, we will have strengthened the entire work of botany in the Islands by bringing in two men who will cover an entirely new field.

Tropical sunlight.—The work on tropical sunlight made it necessary for us to procure a spectograph from one of the very first makers of this class of instruments in Europe. Although such a spectograph could be used for many phases of our work, nevertheless, it seemed scarcely justifiable to purchase it entirely from the funds of the Bureau. As a consequence, an appeal was made to several of the more prominent gentlemen, natives of the Philippines, who are interested in the scientific development of the country. The response was instantaneous, and funds for the purchase of a spectograph were subscribed by Mr. Enrique Zobel, Mr. Antonio Roxas, Mr. Manuel Earnshaw, Dr. Ariston Bautista y Lim, the San Miguel Brewery, and the Germinal Tobacco Factory. The thanks of the Bureau are hereby officially extended to these gentlemen and companies for their extreme kindness.

Republishing.—Our experience of the past has emphasized the desirability of republishing some of the books in the list of this Bureau, which are either out of print or of which the editions are nearly exhausted. The demand for many of these works continues, and, indeed, the call for some of them seems to be greater the less sale copies there are on hand. It is scarcely proper to charge upon one fiscal year the cost of republishing such volumes, where the returns will be received during a period covering several fiscal years. It would seem more advisable, if the Legislature desires to take up the subject of republishing at all, to appropriate a sinking fund of ₱5,000 at the beginning, making this a permanent reimbursible fund from the sales of the second editions of our publications.

The International Plague Congress.—The chief of the biological laboratory was appointed American delegate to the International Plague Conference in China by the State Department at Washington in February, 1911. He was compelled to leave for Manchuria on short notice; nevertheless the Bureau, within two days, was able to furnish the delegate and his assistant with a practically complete laboratory outfit for work with plague and to send with these gentlemen a fairly representative working library on the subject. Our delegates, therefore, had a large advantage, being able to pursue laboratory investigations on the spot. The funds for the expenses of the expedition were, of course, furnished from Washington and by the Imperial Chinese Government, the Philippine Government paying the salaries of the two delegates and providing the apparatus and library.

The Kaiser Wilhelm Institut.—A notable event in the scientific history of the world was the foundation of the Kaiser Wilhelm Institut for the prosecution of original research. His Imperial Majesty, the German Emperor, as a result of the most careful consideration of the condition surrounding scientific investigation in Germany, came to the conclusion

that the professors and docents in the universities, owing to the rapid advance in the number of students, were having their time increasingly occupied with the details of instruction. This condition became more and more serious in the laboratories developed by the German nation, as it began to affect the great advantage it formerly possessed in the large number of eminent scientists who devoted the greater part of their time to the highest type of research, which has assisted so much in developing the resources of the country. It was the opinion of His Majesty that this condition could be remedied by the establishment of independent institutions for investigations in the natural sciences. These institutions should be in touch with the universities and polytechnic schools and should give the members of the faculties of the latter the opportunity to do original work, without being hampered by the onerous duties of teaching. The plan might ultimately result in systematic exchanges for limited periods between the research laboratories and those of the schools of higher learning. In the course of one of the addresses given by those called upon to express His Majesty's views, attention was especially directed to the existence of a number of such institutions in America and it was very gratifying to us to learn that the Philippine Bureau of Science was referred to as a great institution for investigation established by the Government.

The fact that Germany, with all its wealth of universities and technical high schools, should feel the necessity of such separate places for research shows us emphatically that the Philippine Islands did its plain duty in establishing the Bureau of Science. However, the reverse of what has taken place in Germany appears to be occurring here, for the Bureau of Science in the past few years has gradually given certain of its members teaching functions in the College of Medicine and Surgery, and finally, at the request of the Board of Regents, in the new University, and this Bureau runs the danger of having too much time taken away from its real object. All new institutions, as a rule, can command proportionally larger amounts of money than the older and established ones such as ours. Therefore, the University, at present in many cases, is able to offer greater material inducements to secure its men. The resulting danger is that the Bureau of Science will lose its best members, and have the others more or less discontented. One reason why the members of our staff have been given the opportunity to teach in the University has been to secure for them better remuneration than we are able to give. Some have transferred altogether. Therefore, however unwittingly, the Government has founded a new institution which can, by a greater advantage in funds, do damage to another established by the same government. The research laboratories, for which Germany felt so great a need, might be sacrificed to the University, although nothing is further from the minds of the authorities of the latter institution than intentionally to bring this result about. Both the Bureau of Science and the University

should be fostered and to this end the Bureau of Science should be granted sufficient funds to pay its men as liberally as is done in the University. The compensation should be even more liberal, as the members of the staff of the Bureau of Science can not reach the highest positions until they have had a number of years' experience in the Philippine Islands, as the results of intricate problems of research upon which their advancement depends do not become apparent for some time. An increase of our appropriation for salaries and wages by ₱25,000 a year would enable this Bureau to remunerate its investigators in such a way that no danger of any rivalry between the two institutions would ever exist. With parallel salaries an exchange plan between the University and the Bureau of Science might, also, be perfected, as it is proposed to do in the Kaiser Wilhelm Institut.

General.—In the following report, which covers the various divisions of the Bureau, I have somewhat departed from the custom of previous years and in mentioning the various lines of work which we have carried on, I have, so far as possible, omitted the names of the individual workers. This has become necessary because so many men have become capable of doing research and have published detailed articles, that the annual reports almost appear as mere repetitions of names. All articles published by members of the Bureau of Science during the year are given in one place under the heading of the Philippine Journal of Science.

For the past six years the Bureau of Science has been the central scientific library for all the bureaus of the Department of the Interior, not only in the sense of furnishing library facilities, but also in the sense of purchasing books. These purchases included not only bound volumes, but a number of subscriptions to journals. The latter must be bound. Our bills for binding, during the past year, amounted to ₱4,375.58, subscriptions amounted to ₱3,739.58, making an expense of ₱8,115.16 before any books or new sets are purchased at all. Books cost ₱4,156.75 in the last fiscal year, making a grand total of ₱12,271.91. It is obvious that the bill for binding will increase each year as the number of subscriptions and exchanges becomes greater. It seems scarcely fair to expect the library of the Bureau of Science, in view of the growing demand upon it and in view of the fact that it purchases books for all bureaus of the Department of the Interior, to carry this work without some specific appropriation to the library for the purchase of books in addition to the sum which we regularly spend from the general appropriation.

It is recommended that ₱10,000 per year be added to the appropriation of the Bureau for this purpose. The library can not stand still, it must be built up, and the larger it becomes and the greater the public which uses it, the greater must be the demand upon it to furnish the literature in a great number of subjects.

We are very weak in general biology, mathematics, and physics, yet

the University has begun these departments, and will need the literature which has been provided for the departments of work already established.

Another question, which will become serious in time, should be considered now. Other bureaus or institutions are now also purchasing scientific books; an example is the Agricultural School at Los Baños, which already has more than 3,000 volumes on its shelves. It might be true that a scientific worker in one department of the Government would send abroad for a publication necessary for his investigations, although the same publication might be on hand in Manila. It seems most desirable, therefore, to have all scientific books purchased by the Government from whatever funds come through the Bureau of Science library. Our library would then catalogue and number these books and distribute them to the institution making the purchase. In this way there would always be a central catalogue on hand, in which the title of any scientific book in the possession of the Philippine Government could be found. This system has already been followed in respect to the College of Medicine and Surgery.

The necessity of developing our present work on the fishes of the Philippine Islands into a real division of fisheries with its necessary staff, floating laboratories, boats, and apparatus has been emphasized in previous annual reports. The matter is again urgently brought to the attention of the authorities. It would seem as if the time to begin to develop our resources in this direction should now be at hand. It is remarkable that a country, surrounded by water as is the Philippines, should not have made more of fisheries in the past.

THE BIOLOGICAL LABORATORY.

Mr. Moses T. Clegg resigned on September 20, 1910, to accept the position of assistant director in the Laboratory for the Investigation of Leprosy at Molokai. Doctor Teague was on leave in the United States from July 15 to November 1. Dr. E. L. Walker, formerly of the laboratory of comparative pathology of the Harvard Medical School, was appointed assistant in the laboratory on September 2, and assumed charge of the work in protozoölogy. Dr. B. C. Crowell, pathologist in Bellevue Hospital, New York, and Dr. M. A. Barber, professor of bacteriology at the University of Kansas, were appointed assistants in the laboratory on March 14, 1911, and July 3, 1911, respectively. The chief of the laboratory was appointed by the State Department at Washington as American Delegate to the International Plague Conference in China and he and Doctor Teague were occupied with plague work in China during February, March, and April.

ROUTINE WORK.

Clinical and pathological laboratory work.—All the routine pathological and clinical laboratory examinations for the Philippine General Hospital, San Lazaro Hospital, and Bilibid Prison have been performed during the year.

The following table shows the number of routine examinations performed by the laboratory and the increase over those during the preceding year:

Nature of examination.	1910	1911
Fæces	13, 910	14, 223
Sputum	1, 945	780
Blood	597	275
Gonococci	16, 944	13, 997
Waters	343	360
Necropsies	378	238
Miscellaneous	796	5, 772
Total	34, 913	35, 645

The pathological museum, as well as a large number of valuable specimens the property of the chief of the biological laboratory and collected by him in Africa, India, etc., have been rearranged in the College of Medicine and Surgery and the collections temporarily transferred to the museum of pathological anatomy in that institution.

All necropsies for Bilibid Prison have been performed; those for the general morgue being undertaken by the department of bacteriology and pathology of the College of Medicine and Surgery.

INVESTIGATIONS.

Yaws.—During the year a specific cure for yaws was discovered. Ehrlich and his pupils had found that dioxy-diamido-arsenobenzol had produced very favorable results in the treatment of fowl spirochætosis and syphilis and, therefore, the idea suggested itself to try the remedy in yaws, because of the morphologic and biologic relationship which exists between the spirochætæ giving rise to yaws and syphilis respectively. It was found that dioxy-diamido-arsenobenzol is an ideal specific for yaws. Three or four days after the injection of the drug, the granulomatous lesions begin to improve and in the course of from ten to twenty days they usually have disappeared entirely, leaving a perfectly smooth, pigmented skin where the lesions previously existed. The absorption of tumor masses measuring several centimeters in diameter and about a centimeter in thickness in so short a time, and under

the influence of no local treatment, is very striking and surprising. Indeed, in the severe cases the disappearance of the lesions and the cures produced can most aptly be spoken of as marvelous. Even large granulomatous masses or deep ulcerations heal within from two to four weeks. No more striking example in medicine is known than that of the specific action of dioxy-diamido-arsenobenzol on the lesions of yaws. It would appear that this chemical individual is as important a specific for yaws as quinine is for malaria. Therefore, a fourth specific in medicine has been discovered.

Protozoölogy.—In addition to routine diagnostic work upon this subject, a comparative study of the amœbæ found microscopically and culturally in the Manila water supply, in the intestinal tracts of healthy persons, and in those of persons suffering with amœbic dysentery, has been made. This work has been completed, and an article on the subject is at present in press.

An experimental study of the parasitism and pathogenicity of species of the genera *Amœba* and *Entamœba* for man has also been made. A study of the development of *Trypanosoma evansi*, the organism giving rise to surra, in biting flies has been undertaken. This work has been discontinued temporarily because of the disappearance of biting flies, and will be taken up again as soon as the flies become numerous during the rainy season.

Helminthology.—In Bilibid Prison approximately 12,000 specimens of fæces and 1,000 of sputum and numerous specimens of a miscellaneous nature have been examined for animal parasites. During the month of November, helminthologic examinations were made upon 415 lepers of the Culion Leper Colony. A statistical study of intestinal parasites in the people of the tobacco haciendas of the Cagayan Valley and Rizal and Cavite Provinces was undertaken, and several articles on this subject were published in the Philippine Journal of Science. The occurrence of the tape-worm, *Dipylidium caninum* Linn., has been noted in Manila and reported upon during the year. A paper upon the specific identity of the trematode parasites of man in the Philippine Islands is under preparation. It is also intended shortly to make a report upon the nematode parasites, thus completing the series of papers begun by Doctor Garrison in this laboratory in 1907 on the cestode parasites. During the year, a number of valuable specimens have been added to the helminthologic collection.

General.—Some original work has been performed on Addison's disease and adrenal tuberculosis, which will shortly be published in the Philippine Journal of Science. The histology of pneumonic plague at present also is being studied in this laboratory.

Rinderpest.—Studies regarding the etiology and chemotherapeutic

treatment of rinderpest were begun, but it has been necessary to discontinue these, owing to lack of funds.

Leprosy.—The usual routine bacteriological examinations of suspected leprous patients were performed during the year, and bacteriologists were sent on trips through the provinces for the purpose of making such diagnoses of leprosy. A few experiments were performed with salvarsan in the treatment of leprosy, but no favorable results were obtained. Treatment with rectal injections of chloroform and by inhalation, after the method of Conradi, were also tried and found to be unsuccessful. Treatments by injections of glycerine extracts of an acid-fast bacillus isolated from a leprous patient by Clegg were also given, but found to produce no favorable effect. Leprous patients were also treated for two and one-half months with the soap solution of a leprous spleen, rich in leprous bacilli, but no improvement was noted in the condition of the patients. Injections of atoxyl, sodium cinnamate, mercuric cinnamate, and Nastin B also proved ineffective.

Cholera.—Study of the treatment of this disease has been continued during the year, the work being recommenced in San Lazaro Hospital at the beginning of the cholera season in 1910. The essential features leading to the results obtained during previous years were repeated and confirmed. The investigation of the hospital material was carried on in this laboratory in connection with the pharmacologist of the College of Medicine and Surgery. Analyses of the blood gases from the blood of cholera patients were made, and the results supported the conclusions which chemical examinations of the urine had previously suggested. At present the laboratory investigations are being continued to determine in how far the symptoms of cholera result from the loss of fluid. The results of a portion of this work have been published in the Philippine Journal of Science.

Dysentery.—Work upon amœbic dysentery has been continued during the year; a part of the investigations carried on in relation to this subject has been discussed under protozoölogy. The etiology of the disease has also been studied especially, and the methods of diagnosis by means of immunity reactions and the differentiation of the different amœbæ by serum reactions undertaken. The question of treatment, also, has been studied extensively. The results which have been obtained will appear in the forthcoming number of the Journal of Science.

Sera and vaccines.—The work in connection with the care and immunization of the cattle used in the preparation of anticattle plague serum, as before, was in the hands of the Bureau of Agriculture up to January 1, 1911. At the Bureau of Science the serum was filtered and bottled, and at intervals of a few months its potency was determined

on nonimmune cattle. Since January 1, 1911, the preparation of anti-cattle plague serum has been discontinued.

Cholera prophylactic, plague prophylactic, gonococcus, *Staphylococcus albus*, *Staphylococcus aureus*, and typhoid vaccines were prepared in moderate quantities. Antidiphtheritic, antitetanic, anticholera, antityphoid, antiplague, and antidyenteric sera were made in amounts sufficient to supply the demand. Anthrax vaccine, tuberculin, both human and bovine, and mallein were also prepared. Typhoid, paratyphoid, and cholera reagents (killed cultures) for agglutination, agglutinating and bacteriolytic sera in liquid and dried form, for the purpose of the diagnosis of infectious diseases, as well as normal horse, ox, and carabao sera were always kept on hand. Other sera, such as those from the goat, sheep, dog, cat, rabbit, and guinea pig are supplied on request. Vaccine virus was prepared in quantities sufficient to supply the demand. Carcinoma tissue from the surgical wards of the Philippine General Hospital is sent to the Bureau of Science where it is dried and pulverized. The dried, powdered material is used as vaccine against carcinoma.

Rabies.—Since the departure of Major E. R. Whitmore of the Medical Corps, United States Army, who was detailed for work in this laboratory, the work relating to rabies was carried on in the serum laboratory. Since August 1, 1910, 24 dogs were submitted for examination. In 21 of the 24 dogs Negri bodies were demonstrated.

Forty-eight patients who had been bitten by rabid or supposedly rabid dogs were given the Pasteur treatment, and at the present time all are well. Glycerinated cord was sent out for 6 patients and the treatments were given by local physicians. One of these out-patients, who is said to have received the complete treatment which ended January 26, 1911, is reported as having died of rabies February 7, 1911.

Investigations in connection with the serum laboratory.—In connection with the work on rabies, experiments were made to determine how long glycerinated, fixed virus remained virulent. Positive results were obtained for forty-two days; after forty-two days the results were negative.

The duration of passive immunity against tetanus toxine was studied on guinea pigs. It was found that passive immunity disappeared in from two to three weeks.

The question of anti-immune body protection against tetanus received some attention. Guinea pigs received several injections of antitetanic serum. Six weeks after the last injection, each animal received again a fixed quantity of antitetanic serum. Passive immunity was of longer duration in animals previously treated with serum than in those not treated previously. The same was true after repeated injections of normal horse serum.

Horses were used to determine the quantity of tetanus antitoxin necessary to protect when the antitoxin is injected immediately after infection with living *B. tetani* has taken place. The control animal died of tetanus on the fourth day after inoculation, while others, having received 1000, 2500, and 5000 units of antitoxin respectively, showed no symptoms.

THE BOTANICAL SECTION OF THE BIOLOGICAL LABORATORY.

Dr. F. W. Foxworthy was transferred to the Bureau of Forestry on May 31, 1911, leaving the position vacant. Dr. C. B. Robinson indicated his desire to resign shortly after the beginning of the fiscal year 1911-12. A mycologist and a plant physiologist were engaged to fill these two places, but they have not as yet reached the Philippine Islands. The former position is not as yet definitely filled, Dr. Wm. H. Brown, of Johns Hopkins University has accepted the latter.

General work.—The distribution of duplicate material has shown an increase over that of the previous year, and in addition over 2,000 specimens were prepared and incorporated in the herbarium. Over 6,000 specimens of plants have been identified in the course of the year in connection with the taxonomic work in this laboratory, while several hundred determinations have been made for the Bureau of Education, the Bureau of Agriculture, and other bureaus or persons.

There is an increasing demand for botanical information regarding Philippine plants. Much time has been consumed by making miscellaneous determinations for the Bureau of Education in connection with collections, sent in by the division superintendents, illustrating the economic fiber plants of the Archipelago.

Economic work.—As in the past year, a considerable amount of fresh material in bulk has been secured for various employees of this Bureau and the Medical School for chemical and medicinal investigations, while a few calls have come from commercial firms to secure material in bulk of Philippine rubber-producing plants.

With the limited force available here, it has not been found practicable to carry on any great amount of economic work in addition to the more purely technical investigations. A valuable paper on Philippine Hats by Doctor Robinson, quite thoroughly covering this important local industry, was prepared and published in the Philippine Journal of Science. A short article was also written for the Philippine Agricultural Review regarding an outbreak of a serious maize disease in Bontoc Subprovince, caused by *Helminthosporium inconspicuum* C. and E., apparently a recent introduction in the Philippines. The disease first appeared on an introduced variety of maize, known as "Mexican June," but has extended to at least some of the native varieties.

The question of inspection, quarantine, and disinfection of imported plants, bulbs, cuttings, seeds, etc., was mentioned in the previous annual report of the Director of this Bureau, and this incident emphasizes the necessity for a law having for its purpose the protection of the Philippines from imported plant diseases. Practically every civilized country in the world now has strict laws governing the importation of living plants to obviate the chances of introducing insect and fungous pests. Our staple crops are remarkably free from serious fungous diseases, but the coffee industry in the Archipelago, which had assumed large proportions in the last part of the preceding century, was practically destroyed in the last decade by the introduction of the coffee blight, *Hemileia vastatrix* B. and Br., which originated in Ceylon and has spread over the entire eastern hemisphere, devastating coffee plantations in all countries where it has appeared. The Philippines, at the present time, appear to be practically free from many of the serious diseases of sugar cane, tobacco, coconuts, pineapples, and other crops, but it is only a question of time, with increasing facilities for transportation and the establishment of large plantations, until the Archipelago will harbor all or most of the serious pests of tropical agricultural crops, unless steps are taken to prevent their introduction. The Government might take as a model the excellent inspection laws of Hawaii, or of the majority of the English colonies in the West Indies.

Especially trained men are necessary to detect evidence of insect or fungous pests on seedlings, cuttings, or other materials intended to introduce new varieties or species. The entomologists of the Bureau of Science, and the mycologist who will soon be appointed, have this training.

The herbarium.—The herbarium has shown a steady and satisfactory growth, the number of specimens received, poisoned, mounted, and distributed into the collection aggregating 10,621 sheets.

The material has been received from the following sources:

Collections made by employees of—	
The Bureau of Science	3,354
The Bureau of Forestry	613
Miscellaneous Philippine material by gift, exchange, etc.....	2,667
Extra-Philippine material received in exchange	3,749
Total	10,383

The total number of specimens now in the herbarium is 93,283, of which 61,497 are Philippine, the remainder extra-Philippine.

Among the Philippine collections received, other than those made by employees of this Bureau or the Bureau of Forestry, the most noteworthy is that made by Father M. Vanoverbergh, a missionary stationed

at Bauco, Bontoc, who has sent in during the year an aggregate of 796 numbers, representing nearly that number of species. Five hundred and fifty-six specimens collected in Luzon by A. Loher, were received from the Royal Gardens, Kew, in exchange, while there have been incorporated in the herbarium about 620 specimens collected in various parts of the Archipelago by Professor C. V. Piper of the United States Department of Agriculture.

Exchanges.—The foreign material, for most part received in exchange, has been from the following sources:

Miscellaneous	12
Jardin Botanique, Buitenzorg, Java: Malayan plants	153
A. Morrison, Subiaco, West Australia: Australian plants	237
Royal Botanic Garden, Calcutta, India: Indian plants and plants from the Malay Peninsula	444
Botanic Garden, Sydney, New South Wales: Australian plants..	200
Dr. R. Schlechter, Berlin: Sumatran orchids	41
F. Mason Bailey, Department of Agriculture, Brisbane, Queens- land: Queensland plants	306
Bernice Pauahi Bishop Museum, Honolulu: Hawaiian plants..	200
United States National Museum: West Indian ferns	100
C. G. Pringle, Burlington, Vermont: Mexican plants	100
Kgl. Botanisches Museum, Berlin, Germany: Tropical African plants	970
Botanic Gardens, Singapore: Malay Peninsula plants	242
National Herbarium, Melbourne, Victoria: Australian plants..	66
Indo-China plants, collected by C. B. Robinson, Bureau of Science	556
Hongkong, Singapore, Colombo, and Port Said plants collected by H. M. Curran, Bureau of Forestry	122
Total	3,749

The largest exchange received is that from the Berlin Botanic Garden. This contains 970 specimens of tropical African plants, among them a very large number of species of special interest to us. Another very noteworthy collection is that made by Dr. C. B. Robinson of the Bureau of Science, chiefly near Nha Trang, Annam, Indo-China, March, 1911. Doctor Robinson went to Indo-China primarily on a vacation trip, but the fact that he collected a total of over 550 numbers in 15 days, for most part with ample duplicate material, indicates that he spent practically all this time collecting and preparing botanical specimens. His collection shows a rather remarkable similarity between the flora of Indo-China and of the Philippines, about 20 per cent of the species being common to the two countries. The first set of this material has been incorporated in our herbarium, and the second sent to the Museum of Natural History, Paris, France, in order that botanists who are working on the flora of Indo-China can check the correct-

ness of our determinations and give us the names of the species not possible of exact identification here.

Early in the year 1911, arrangements were made with Mr. J. C. Moulton, curator of the Sarawak Museum, Sarawak, Borneo, by which this Bureau advanced to him a small sum of money with which he has very kindly, and at his own suggestion, employed for us a native collector in order to strengthen our collections of Bornean material. Mr. Moulton has undertaken to supervise the collector, and from time to time pack and ship to this Bureau the botanical material secured. The first shipment has recently arrived in Manila and will doubtless be received by the Bureau within a few days. If this plan proves to be practicable, it will mean that we shall enrich our collections in greatly needed Bornean material at a very slight expense. Borneo is practically unexplored botanically, and the value of material from that great island for comparative purposes is evident.

Following the general policy of making one large distribution of duplicate botanic specimens each year, the labels of the duplicates in all series were completed and the specimens distributed into sets, these sets being forwarded to various institutions and individuals with which we have exchange relations. Below is given a summary of all material sent in the past twelve months:

United National Museum, Washington, D. C.....	3,517
New York Botanical Garden, Bronx Park, N. Y.....	1,914
Royal Garden, Kew, England	596
Kgl. Botanischer Garten und Museum, Berlin, Germany	2,552
Royal Botanic Garden, Calcutta, India	1,232
United States Department of Agriculture, Washington, D. C..	321
Jardin Botanique, Buitenzorg, Java	1,805
Botanic Garden, Sydney, New South Wales	744
Dr. R. Schlechter, Berlin, special orchid exchange	345
Herbarium of Prince Roland Bonaparte, Paris, France	2,186
Musée d'Histoire Naturelle, Paris, France.....	4,216
Jardin Botanique de l'État, Brussels, Belgium.....	875
E. B. Copeland, Los Baños, Laguna Province, Luzon	778
Department of Agriculture and Forestry, Honolulu, Hawaii..	480
A. Morrison, Subiaco, West Australia	347
Dr. A. W. Evans, Yale University, New Haven, Connecticut..	60
Rijks Herbarium, Leyden, Holland	2,652
Royal Botanic Garden, St. Petersburg, Russia	996
Department of Agriculture, Brisbane, Queensland	807
Auckland Museum, Auckland, New Zealand.....	340
Bernice Pauahi Bishop Museum, Honolulu, Hawaii	312
National Herbarium, Melbourne, Victoria.....	255
T. O. Weigel, Leipzig, Germany, 2 centuries of Philippine Plants, 15 sets each	3,000
A. Kneucker, Karlsruhe, Baden, Germany, 24 species of grasses and sedges, about 110 specimens each.....	2,640
Total	32,970

In addition to the above material distributed on our general exchange account, the following 671 duplicate specimens have been sent to various specialists for determination or for verification of our determinations:

Algae to Dr. M. A. Howe, New York Botanical Garden, Bronx Park, N. Y.....	21
Hepaticae to F. Stephani, Oetzsch, near Leipzig, Germany	66
Fungi to Dr. G. Lindau, Kgl. Botanisches Museum, Berlin, Germany	158
Mosses to Dr. V. F. Brotherus, Helsingfors, Finland	127
Piperaceae to C. DeCandolle, Geneva, Switzerland	45
Selaginella to Dr. Hieronymus, Kgl. Botanisches Museum, Berlin, Germany	53
Araceae to Dr. Engler, Kgl. Botanisches Museum, Berlin, Germany	25
Gesneriaceae to Dr. Fr. Kränzlin, Berlin, Germany	31
Asclepiadaceae to Dr. R. Schlechter, Berlin, Germany	93
Symplocaceae to Dr. A. Brand, Frankfurt a. d. Oder, Germany....	11
Sapindaceae to L. Radlkofer, Munich, Germany	11
Carex to Rev. G. Kükenthal, Coburg, Germany	16
Miscellaneous	14
Total	671

The total number of duplicate specimens distributed for all purposes was 34,605.

Loans of mounted specimens to specialists have been as follows:

Orchidaceae to Oakes Ames, North Easton, Mass.	436
Selaginella to Dr. G. Hieronymus, Kgl. Botanischer Garten, Berlin	21
Strychnos to A. W. Hill, Royal Gardens, Kew, England	26
Millettia to S. T. Dunn, Royal Gardens, Kew, England	18
Asclepiadaceae to Dr. R. Schlechter, Berlin, Germany.....	31
Gesneriaceae to Dr. Fr. Kränzlin, Berlin	3
Crassulaceae to Dr. R. Hamet, Musée d'Histoire Naturelle, Paris, France	13

During the past year the following additional exchanges have been arranged: Auckland Museum, Auckland, New Zealand, for New Zealand; National Herbarium, Melbourne, Victoria, for Australia and Polynesia; Bernice Pauahi Bishop Museum, Honolulu, for Hawaii; Department of Forestry, Honolulu, for Hawaii; Department of Agriculture, Brisbane, Queensland, for Australia; Rijks Herbarium, Leyden, Holland, for Malayan plants, A. Morrison, Subiaco, West Australia, for Australia; and C. G. Pringle, Burlington, Vermont, for Mexico. Requests for exchanges have been addressed to other institutions in various parts of the world.

A special exchange was arranged with the firm of T. O. Weigel, Leipzig, Germany, by which duplicate specimens of special sets are sold by this firm, and this Bureau given credit for the money so taken in to apply to the purchase of books for the library; 15 sets of two addi-

tional "centuries," a total of 3,000 specimens have been prepared and shipped. The sale of this material has amounted to ₱800, and at the present time we have sufficient material on hand to prepare 15 sets of 4 additional "centuries."

During the past twelve months some time has been given to the botanical exploration of the vicinity of Manila, in the triangular area extending from Parañaque inland to Pasig and from Pasig to Malabon, with the object of writing a manual to be termed "A Flora of Manila." Extensive exploration has greatly enlarged the preliminary list that was prepared for field work, and the preparation of the manuscript of the "Flora" is now so far advanced that it will probably be ready for publication within a few months. This work will include descriptions of about 1,000 species and, for all practical purposes, will be a flora of all Philippine towns at low altitudes. It will fill a long-felt need among those who desire to know something about the vegetation of the country, and should, moreover, be of great value in school work, as it can be used to advantage as a text book in all the higher schools in the Archipelago.

Botanic garden.—The question of the establishment of a Government Botanic Garden has been discussed in previous reports, and it now seems probable that within a year or two such an institution will be established. The City of Manila has acquired a tract of land in Malate, along the southern boundary of the city, and it is planned to develop this as rapidly as possible as a park and botanic garden. As much of the land is low, a large amount of grading will be necessary before much planting can be done, but probably within two years the walks and drives can at least be staked out, and a certain amount of planting done. This Bureau will assist the project in every way possible. Even before the park is staked out, something can be done in the general supervision of the collection of seeds and living plants, both Philippine and foreign, for propagation in the city nursery at the Cementerio del Norte. This possibility has been called to the attention of the Municipal Board of the City of Manila, urging the immediate enlargement of the collection of living plants at the Cementerio del Norte, in order that, as soon as the Malate grounds are in readiness for planting, sufficient material may be on hand and at a proper age for successful transplanting.

THE ENTOMOLOGICAL SECTION OF THE BIOLOGICAL LABORATORY.

Routine work.—The work of preparing material for the collection has been held somewhat in abeyance owing to the fact that the boxes and cabinets available for insects have become overcrowded. The transfer to quarters in the new wing and the arrival of about 2,000 insect boxes will remedy this difficulty. A price list of Philippine insects has been prepared. In connection with this it was necessary to identify a considerable amount of material which otherwise would have been

kept until a sufficient quantity had accumulated to make it worth while to send it to specialists.

Accessions.—The most noteworthy accessions were made as the results of a trip to the Cagayan Valley by Messrs. Banks and Jones for the purpose of investigating the insects which attack tobacco. Several thousand insects in all orders were acquired, very many species being new to our collection and some undoubtedly new to science.

The accession numbers for last year begin with 13,678 and extend to 14,406; 1,139 lots of insects were added to the collection, representing 5,500 insect specimens. This does not include about twice that number as yet stored and not accessioned.

Donations.—D. C. Worcester and F. Worcester donated a large number of miscellaneous insects of interest captured by them during a trip to the Agusan River, Mindanao, in 1910. Mr. T. C. Zschokke of the Bureau of Forestry brought in a collection of miscellaneous insects chiefly containing Coleoptera and Hemiptera from the region of Zamboanga; Mr. H. M. Curran of the same bureau has also made donations of miscellaneous forest insects from time to time.

Others have donated individual specimens during the year and have been given due credit on our cards.

Exchanges.—Exchanges have been effected with the following:

Sarawak Museum; Lepidoptera, Coleoptera, Hemiptera.

M. André Théry, Alger, France; Buprestidae.

Dr. Walther Horn, Berlin, Germany; Cicindelidae.

Baron Gustav von Plessen, Munich, Germany; Lepidoptera.

Sales.—The price list of insects was ready for distribution some four months ago and has been sent to a large number of prospective purchasers of Philippine insects. One or two sales of single specimens of such insects as *Attacus atlas* have been made to visitors. A single sale amounting to ₱120 was made of miscellaneous Lepidoptera, but it is yet somewhat early to hope for results from our advertising. In connection with sales of insect specimens the necessity for having a good native collector or two, especially for butterflies, is very apparent.

Classification and identification of material.—A large collection of beetles was identified and returned by Doctor Haller of Dresden and this makes possible the better arrangement of our steadily growing collection of these insects. It also enables us to identify material of an economic character sent in by farmers and others who wish information concerning the cause of damage to their crops.

Mr. Schultze took with him to Europe, on his leave of absence, some 1,400 insects in Lepidoptera and Coleoptera which he expects to identify, with the aid of European specialists.

A manual on silk culture has been prepared and is now in press.

Exhibit at Philippine Carnival.—This year's Carnival exhibit em-

phasized more particularly the question of silk culture from the standpoint of the small grower and was intended to show the average man what can be done without the aid of elaborate machinery and on a small farm. We were able to show, also, many finished silk products made at the Batac School Farm, in Ilocos Norte, where instruction is given according to methods pursued in our silk laboratory at the Bureau of Science.

Silk culture.—The work in silk culture has progressed favorably. It is the intention to breed and keep on hand only such quantities of silkworms as will insure the stability of the Philippine race of silkworms and to supply eggs for those competent to carry on the work.

Experimental work with the eri silkworm proved highly satisfactory and an excellent silk was obtained from these insects. It was found by accident at the last Carnival that this silk can easily be spun on hand apparatus such as the Visayan women use in the spinning of cotton. The industry with eri silkworms could be carried on easily in connection with mulberry silk culture, the proper procedure being to plant mulberries and castor plants simultaneously and then work with the eri silkworms when the castor plants acquire the age of six months and until the mulberry trees can be used, two years after planting.

Mosquito extermination work in Manila.—In the month of August, 1910, after a thorough canvass of the field, a plan was suggested to the Director of Health, whereby a temporary antimosquito brigade might be established looking toward the eradication of the brown mosquito, *Culex fatigans* Wied., in the City of Manila and incidentally the lessening of the day mosquito, *Stegomyia persistans* Banks.

The work was not permanently organized until February, 1911, since which time we have been receiving the coöperation of the Bureau of Health and the Municipal Board of Manila. It is safe to state that the brown mosquito practically has been exterminated in Manila. It is now almost impossible to secure specimens of it for experimental purposes.

It is believed that this is the most serious mosquito pest we have, but it can not be denied that, occasionally and for limited periods, other mosquitos might breed, if conditions favorable to them were provided. This has been more than strikingly borne out recently by finding *Culex microannulatus* Thoebl., another vicious biter, breeding in artificial pits, ponds, and pools created in the process of construction going on at the new fill on the water front and other work of improvement and beautifying in the City of Manila. This mosquito, like the brown one, has distinct and peculiar habits and can be kept down if one branch of the Government will coöperate with another in preventive measures.

The work of eradication was somewhat crippled when the American sanitary inspector in charge of it went to the United States on leave.

It can readily be understood that, unless this work is continuously and steadily pushed under the supervision of intelligent sanitary inspectors, there will be a gradual reintroduction of *C. fatigans* and a return to previous conditions. A steady campaign, looking to the permanent eradication of insanitary breeding places in homes and adjacent premises, should be carried along with the work of inspection and oiling. However, it is generally the custom, if mosquitos return, to argue that the observed facts regarding their life-history are wrong, rather than to look to careless oiling or the lack of discovering insanitary spots as the cause. The expense of mosquito extermination is not great, but the work must be thorough.

Research.—Early in the year an expedition was made to the Cagayan Valley to investigate the insect infestation of tobacco. This trip strengthened the previous conviction that the greatest present menace to Philippine tobacco lies *not* in the field but in the *factory*; this for two reasons: (1) It will be next to impossible with the present quality of labor, to keep out insects from the growing or drying crop. (2) A leaf damaged in the field is not a total loss to the manufacturer, he is always able to use such a leaf for filler or cigarettes, while cigars infested with the tobacco beetle in manufacture, or after storing, show these effects only when opened by the American or European buyer or ultimate consumer. Therefore, damage to the finished product gives Philippine tobacco a bad reputation.

The remedy lies, for the present, in making and packing cigars and cigarettes under conditions which will exclude the beetle from the wares until they are upon the market. This can and must be done before Philippine tobacco will regain its prestige.

At the request of the Manila Railroad Company, Mr. Banks visited their colony at Caloocan for the purpose of studying the conditions under which mosquitos were breeding and to suggest a means of combating the pests. It is yet too early to report on the success of this undertaking, but to judge from conditions found the work should be very simple if the plan outlined is followed.

THE SECTION OF FISHERIES OF THE BIOLOGICAL LABORATORY.

A report on the pearls and pearl fisheries of the Philippine Islands was prepared and published. An extensive collection of fishes from Bantayan Island was identified and descriptions of four new species given. The work on the transference of black bass into the Philippines has now progressed so far that we were able to prepare a definite report on the subject, which also embodies notes on the transportation of live fish long distances, for Mr. Seale transferred a number of black bass to Hongkong and, during his stay at that port, made an extensive collection of fishes. Bornean material, also, has accumulated and a paper on Bornean fishes has been

published. Experiments on the artificial propagation of the window-shell mollusk were begun.

Statistical work.—A circular letter was sent to all of the municipalities in the Islands, requesting information regarding the number of regular fishermen engaged in the industry in each municipality, the number of fishing boats and of nets, the size and number of the fish corrals, and the amount of taxes paid by the fishermen on such boats, nets, and corrals. The returns have all been tabulated and form a valuable basis for future intelligent legislation.

Economic work.—On July 30, 1910, 40 black bass were taken to Hong-kong and planted in a spawning pond which the Hongkong Government had prepared, a small number were also planted in the Tytam reservoir.

In March, a visit was made to the bass ponds in Baguio. Poaching on an extensive scale was being carried on by the natives, 32 set lines being captured in Trinidad pond, and a number of small artificial flies with which the native boys were catching young bass were confiscated. These facts were reported to the Governor of the Province. On March 16, 20 black bass were taken to Haight's Place, 60 kilometers above Baguio, where a spawning pond was formed by building a 10-meter dam. It is believed that the fish will thrive at this place. A spawning pond had been built at Los Baños, from which place we hope eventually to stock the lakes in Laguna Province.

One hundred tins of sardines and anchovies were prepared at the Bureau and exhibited at the Carnival. These tins were then sent by mail to the various dealers in Manila, and to canning establishments in the United States, with a circular letter calling attention to this valuable fishery asset of the Islands. Numerous letters of inquiry were received in return, and certain companies have expressed a desire to enter this field.

Specifications regarding the construction of large fish nets for the Penal Colony at Iwahig were supplied to the Bureau of Prisons; as a result, the colony now secures all the fish it can use, and several thousands of pesos, heretofore paid for salmon and meat, are saved to the Government. Similar plans have been given to the Bureau of Health for securing fish for the Culion Leper Colony, with the additional suggestion that fish ponds should be constructed at that place. These ponds would not only supply food for the natives, but would give them interesting and profitable employment.

Food and game fishes.—A marked increase of interest in our food and game fishes has been evident during the past year and, largely through the interest of the Governor-General, the game fishes of the Islands are becoming better known and more appreciated.

It has now been demonstrated conclusively that sea fishing with rod and reel in the Philippines is equal in every respect to the fishing at Catalina Island, or on the coast of Florida. During one day's fishing with rod and reel in Malampaya Sound, a party of eight caught 248 kilograms of game fish consisting of Spanish mackerel, pampano, barracuda, leather-jacks, bonito, and groupers. The individual weights of the fishes ranged from 2 to 14.5 kilograms. The entire catch for a fishing excursion lasting three weeks was 754 kilograms of game fishes.

General marine products.—This section of the biological laboratory has for some years been gathering data on the marine turtles and tortoise shell of the Islands. It is believed that a profitable business in the manufacturing of tortoise shell articles can be built up in the Philippines. The yearly export of tortoise shell is about 2,000 kilograms, valued at ₱35,000. Shells for use in the manufacturing of buttons are also an important marine asset. The demand for this class of shells has increased greatly during the past year and this fact has stimulated the efforts for gathering them to a marked degree; 700,000 kilograms of shells, valued at ₱300,000, from which buttons are manufactured, are secured in the Philippines each year. Trepang, or *bêche-de-mer*, also is a valuable commercial asset of the Islands, the value of the exports in trepang for 1910 being ₱51,682. Sharks' fins each year also reach an export value of about ₱85,000.

Mr. Seale has gathered the facts in regard to these general marine products into a series of articles, some of which are completed and others are to be published in the near future.

THE SECTION FOR THE COLLECTION OF NATURAL HISTORY SPECIMENS OF THE BIOLOGICAL LABORATORY.

During the fiscal year ending June 30, 1911, field work in the collecting of natural-history specimens was carried on in Cavite Province; at Obando, Bulacan Province; and at Calauang, Laguna Province. Valuable specimens were secured in Palawan, northern Mindanao, and on islands in the Sulu Sea during a trip made through the courtesy of the Secretary of the Interior. Some specimens were collected in the vicinity of Manila, and records of birds sold in the markets were continued. Five wall-cases of mounted birds were prepared for the Museum and exhibited at the 1911 Carnival. Several pieces of taxidermic work were mounted as private work.

A revised price and exchange list of bird-skins was printed and mailed. The prices have been reduced materially. The collector of natural history specimens was detailed to work on the *Philippine Journal of Science* during January, and on May 1 was appointed assistant to the editor of the *Journal*.

THE CHEMICAL LABORATORY.

It finally has become necessary to separate the chemical laboratory into two divisions, one of general, inorganic and physical chemistry, and the other of organic chemistry. The former has charge of cements, concretes, road materials, waters, soils, minerals, and all similar products, as well as of the calibrating and standardizing of all weights and measures and of the testing of materials. The latter takes care of examinations under the Food and Drugs Act, of sugars, milks, alcohols, poisons, papers, paints, oils and varnishes, urines and similar things presented for examination.

As a result of this division, the totals of routine work done during 1911 are separated in two individual reports, where formerly they were combined, so that an adequate comprehension of the increase during 1911 can not be gained without a preliminary paragraph in which all is united.

In 1910 a total of 5,168 analyses, tests, or determinations were made, whereas in 1911 this number reached 7,555, an increase of 46 per cent, not counting the work done at the Iloilo laboratory, which amounted to 1,737 determinations of sugar and 9 soil analyses, making 9,301 in all, or a total increase of 80 per cent.

These figures speak for themselves in regard to the increased use of the chemical laboratories by the public. To keep this mass of requests for analyses even reasonably clear, the chemists need to put in an amount of time and energy beyond what should reasonably be expected, and research work, which is one of the most necessary functions of the Bureau, has necessarily suffered severely. The results of research pave the way for future extensive commercial development.

In view of the great increase in the demands on the chemical laboratories, it has become more and more difficult to turn out the work promptly. However, the work of our laboratories is peculiar in so far as many of the determinations, in the very nature of things, *can not* be postponed. The above conditions will compel the Director of the Bureau to ask for a decided increase in the chemical staff at the next meeting of the Legislature.

The work of the laboratory of organic chemistry further has been handicapped by the demands of the Philippine University. In order adequately to train young Filipinos as assistants and, also, to give the University the broader facilities in apparatus and men afforded by the Bureau of Science, it seemed best for us to take part in the work of instruction. The Director of the Bureau, therefore, was appointed professor of chemistry in the University; Mr. H. D. Gibbs, chief of the laboratory of organic chemistry, associate professor; and Mr. José I. del Rosario, instructor. This takes out of our laboratories two active

members for nearly one half of each day, not counting the time necessary for preparation. It is true that the University turns over to the Bureau of Science the sum of ₱5,000 to enable us to secure additional assistance, but as yet no candidate has appeared. However, even when this position is filled, the chemical laboratories will only, practically, be on the same footing as they were a year ago.

THE LABORATORY OF GENERAL, INORGANIC AND PHYSICAL CHEMISTRY.

Dr. Alvin J. Cox was appointed chief of this division on November 5, 1910. Two vacancies were filled during the year by Mr. Forrest B. Beyer and Dr. A. P. West, who arrived in September and November respectively. Early in the year a large number of sets of measures of weight, length, and capacity arrived for calibration as Philippine municipal standards and in order to calibrate these and to maintain the usual work in *statu quo*, research was held in abeyance, and every member of the staff devoted himself to routine. Mr. Beyer and Doctor West arrived in time to relieve the pressure.

The routine work includes all inorganic chemical work. The variety is shown by the fact that in a single day this division has carried on illumination tests of oils; heat insulation experiments; analyses of rocks, limestones and cements, waters, soils, fertilizers, coals, and alloys; calorimetric determinations of fuels; standardizations of instruments of precision, of measures, and of solutions; as well as physical tests of clays, cements, aggregates, road materials, textiles, such as puttees, khaki cloth, rain-coats, and blankets, of reinforcing iron and of rope. Statistics show that the public has availed itself of the opportunity to have chemical work done at this laboratory more than ever before. During the year it has made the following analyses and tests, the totals are compared with the year 1910.

Nature of analysis or test.	1910	1911
Rocks and minerals		25
Soils, fertilizers, cements and clays	3,342	3,724
Metals and alloys	24	46
Road materials, stone, gravel and sand		440
Ash analyses		14
Water	82	164
Calorimeter determinations of fuels		29
Coal tests		10
Coal analyses		154
Weights and measures standardized, sets		1,066
Miscellaneous ^a	248	
Total	3,696	5,672

^a Work classified under "Miscellaneous" in 1910 is segregated in 1911.

In many of the analyses enumerated above, a long and sometimes complicated separation, often of a dozen or more different elements, is involved. In the item of 1,066 sets of weights and measures, 7,000 individual pieces of apparatus were standardized. There are seven chemists in this division, of whom four are Americans and three natives of the Philippine Islands, and in order to save time, the labor of the workers is somewhat classified. Two have devoted the larger part of their time to cement and physical testing, one to the custom house work which consists of the examination of miscellaneous materials such as table knives, forks, spoons, shears, wire, foil, metal thread and trimmings, spangles, key rings, collar buttons, beads, fancy boxes, and hair pins for valuation and classification; another to the analyses of fuels and inorganic materials; one to the analyses of waters, one to those of rocks and minerals, and one to the analyses of soils and fertilizers, while most of the work in physical chemistry has been handled by the chief of the division. This segregation has not been adhered to rigidly for this is neither possible nor advisable. Occasionally there is a rush of work in one line when as much assistance as possible is necessary. There is enough shifting by sheer necessity to preserve that broad outlook and interest of the men which is necessary for the greatest efficiency.

Theoretical and other problems not covered by this classification come up continually and are dealt with individually. Although manufacturing in the Philippines is still in its infancy, the laboratory has several times been able to solve troublesome chemical manufacturing difficulties.

There have been a number of demands for tests and controls of materials furnished on large contracts, such as steel rails or paints. All government supplies should be purchased under specification and all deliveries of materials so purchased should be controlled by tests, and the bureaus of the Government which have to do with purchasing are adopting this view to a greater extent than ever before. The Bureau of Constabulary, for example, has taken advantage of the facilities of the Bureau of Science for testing materials and now award their contracts for supplies on the basis of our tests. Specimens from every delivery are checked. By the purchase of supplies on the basis of specification, the Government is able to save money and secure better materials.

During the year our equipment for testing road materials, which is a duplicate of that used by the Division of Roads in Washington, arrived and we are now able to complete all tests, including the abrasion, cementing value, and resistance to fracture of road materials. A number of such tests has been made, and there is an increasing demand for this class of work.

The cement testing laboratory of the Bureau of Supply was combined

with that of the Bureau of Science in June, 1911. The Bureau of Science for several years has examined all the cement used by the Bureau of Public Works, the City of Manila, and certain other parts of the Government, as well as by the Military Government. Now that the Bureau of Supply has also come to this laboratory, all of this work hereafter will be done in one place. This work in the past two years has included, also, extensive tests on concrete blocks used in construction work, for the knowledge is rapidly spreading that the cement is not the sole determining factor in projects in which this material is utilized, for the sand and gravel, or crushed stone, plays at least as great, if not a greater part in the strength of the structure as a whole.

In order to assist the Purchasing Agent to secure complete information regarding the coals available for use in the Philippines, the laboratory was requested to sample all ships' cargoes of coal coming into Manila Harbor. This work was begun in December, 1910, and continued until May. Over 100 samples were taken and analysed.

INVESTIGATIONS.

From March 9 to May 12, the chief of the laboratory of general, inorganic and physical chemistry was acting director of the Bureau of Science and the duties of this office largely absorbed his time and during the last month of the year Mr. Reibling, in charge of the cement work, was on leave en route to the United States and Europe where he expects to devote especial attention to cement, concrete, hydraulic materials, and road construction. In spite of these facts, the large amount of routine work and the shortage of assistance, the division of general, inorganic and physical chemistry has completed a certain amount of research work.

Two papers have appeared in Section A of the Philippine Journal of Science on the physical properties of Portland cement and a third one is in press. In the course of this work, the methods of testing for free lime in Portland-cement clinker and in the finished product were perfected in such a way that an exact distinction can be made between calcium oxide, as such, and when surrounded by a partially sintered slag, and calcium hydroxide. The effects of various methods of seasoning were then taken up and their influence on the setting properties of cements in relation to the free lime carefully studied; the effects of plastering, also, were considered. Finally, the results of a number of years of study on the problem of the relation of these factors to the final strength of the materials were correlated with the work which has been outlined. All of these investigations have given us a more reliable product for construction work in the Philippine Islands.

An article from this division has been published in the Philippine Journal of Science dealing with Philippine fire-wood in which all the various woods used for this purpose in the Archipelago are discussed. Analytical data as to their value and tables, comparing them with the most commonly used European and American woods, are also given. The three most important factors controlling the value of a wood for fuel are the content of moisture, the content of ash, and the specific gravity. The available heating value of the combustible matter of wood, wood—(water+ash), is practically constant and is equal to 4,418 calories. From this number the available heating value of a wood may be calculated when its moisture and ash content are known.

The important subject of the soils of the Archipelago has been given extended attention during the year, much new work of an analytical nature has been done, and the Schöne method for the mechanical analysis of soils has been modified and perfected so as to be adapted to our needs. The various soil analyses done in this Bureau since its beginning have been collated and the whole brought into a paper which deals with the general question of Philippine soils and the nature of the crops to be grown on them. In interpreting the results of analyses it became necessary to collect all available data in regard to the distribution of rainfall in the Archipelago and to plot the results by districts and to carry them in on a map of the Philippine Islands. When this is done a most remarkable geographical regularity in regard to this distribution becomes apparent. This work marks the beginning of an attempt to correlate all factors relating to the intricate connection between soils, climate, and crops.

The division has taken up the detailed study of the salt resources and of the industry in the Philippine Islands. Salt is now extremely expensive and is produced in limited quantities; 7,500,000 kilograms of this article are annually imported into the Philippines. At present salt is prepared by a very crude and simple process from sea water. The surface of land, approximately at the level of high tide, is loosened and water from canals is sprinkled over the area, where the water rapidly evaporates. This process is repeated until a quantity of salt has accumulated on the surface, whereupon the loose earth together with the salt is scraped into heaps and collected into leaching vats; the leaching is performed with sea water, and the strong brine is transferred to shallow crystallizing vats.

Another method consists in preparing large, shallow evaporation lakes in which the first evaporation takes place. When the water contains about 10 per cent of salt by weight, it is transferred to crystallizing vats for final evaporation. The Ilocanos vary the process by evaporating

the final leaching in *cauas*, or large iron kettles, mounted on rude clay furnaces. Sometimes the process is much less refined. A fire is built on the beach and sea water continually sprinkled on, just enough not to put out the fire. Finally the fire is allowed to burn out and the final evaporation made by artificial heat as above outlined.

The salt supply of the Mountain Province for the greater part comes from Cervantes. The article is sold to the people at exorbitant prices. The people of the Mountain Province also produce a very small amount of a poor grade of salt by evaporating water from brackish springs in *cauas*, obtained from the Ilocanos, mounted on rude furnaces built of stone and clay. The water from these springs is being analyzed to determine if it is not possible to develop an industry which would furnish an adequate supply of salt at a reasonable price.

A scientific study of this industry will lead to an improvement in the quality and to an increase in the output of each individual employed in this industry. Possibly in the future a large industry can be developed in the Philippines.

THE LABORATORY OF ORGANIC CHEMISTRY.

Mr. Harry D. Gibbs was appointed chief of this division on November 5, 1910. Mr. Benjamin T. Brooks resigned his position in May, 1911. His place, up to the present time, has not been filled.

During the year the following analyses and tests were performed; the totals are compared with those of the year 1910:

Nature of analysis or test.	1910	1911
Examinations under Food and Drugs Act	1,004	458
Miscellaneous food examinations		44
Sugar analyses		117
Analyses of local milks		261
Alcohol determinations		155
Analyses of paper		133
Analyses of paints	61	31
Analyses of lubricating oils etc.		65
Analyses of ilang-ilang		13
Analyses of gutta percha		10
Miscellaneous analyses		34
Poison investigations		12
Analyses of stomach contents		9
Analyses of human milk		36
Urine analyses	400	473
Examinations under opium law		32
Miscellaneous*	7	
Total	1,472	1,883

* Work classified under "Miscellaneous" in 1910 is segregated in 1911.

The examinations required in the enforcement of the Food and Drugs Act are itemized as follows:

Nature of sample.	Number examined.	Illegal.
Miscellaneous meats and meat products	40	11
Miscellaneous fish products	37	11
Canned milks	36	14
Butter	40	3
Cheese	13	3
Asparagus	38	4
Miscellaneous canned vegetables	16	4
Flour	15	3
Infant foods	5	2
Miscellaneous vegetable products	17	2
Preserves	38	0
Chocolate	4	2
Extracts	10	2
Tea and coffee	21	3
Soft drinks	11	2
Wines	12	3
Beer	6	2
Miscellaneous liquors	15	3
Vinegar	5	1
Medicines and drugs	53	23
Miscellaneous	26	3
Total	458	101

Twenty-two of the samples examined under the Opium Act were found to contain opium. The majority of local milks examined were from the carabao. A considerable number of these were found to have been adulterated. Of the samples examined under the Food and Drugs Act, only 23.1 per cent were found to be illegal, a very notable improvement on years past. A very considerable number of these were wholesome and the manufacturers were found to be guilty of nothing more than some infraction of certain regulations of comparatively minor importance. Compounds of boron in large or small amounts were found in 6 samples, benzoic acid in excess in 1, sulphurous acid in 7, and an excess of tin salts in 2. Acetanilid was found in 7 (Japanese) medicines. Altogether, a very marked improvement in the quality of imported foods and drugs was noted.

THE ILOILO SUGAR LABORATORY.

The Iloilo sugar laboratory was reopened on December 13, 1910, with Mr. Walter B. Gonder in charge. Owing to lack of work, it was closed at the end of the sugar campaign of 1909-1910, in March, 1910. During the present campaign up to June 30, 1910, it has performed 1,737 polarizations and 9 analyses of soils.

Therefore, this laboratory has begun successfully to fulfill one of

the functions for which it was established, for it has acted as a third, disinterested party to arbitrate disputes between *hacenderos* and dealers. The laboratory also repeatedly has been called upon for advice upon practically everything relating to sugar, in one form or another, while the confidence of the dealers has been attained to the extent of having the laboratory polarize every exportation of sugar.

INVESTIGATIONS.

During the year this laboratory has continued to take part in the continued investigation of the tropical sunlight, begun in 1909. Determinations of the total violet and ultra-violet insolation, by means of a solution of oxalic acid containing uranyl acetate have been continued systematically so as to cover an entire year, and in this way to give an average for all weathers. They were also carried on in Baguio and thus the influence of different altitudes ascertained. The changes in the amount of decomposition due to different shapes and sizes of flasks, as well as of the materials of which they are made, were ascertained, and experiments were also conducted in open dishes covered with different kinds of U-viol glasses. The work on the ionization of the air, begun by Doctor Bacon, was continued with an apparatus carefully modified to meet local conditions and the conclusion reached that such ionization did not take place, but that ions which are present are swept down from the upper currents of the atmosphere.

The work begun by Doctor Aron, of the department of physiology in the College of Medicine and Surgery, was continued in this laboratory, Doctor Aron's entire apparatus being transferred to Baguio. The direct sunlight at this altitude, despite the fact that the average of the air temperature is approximately 7° to 10° lower than in Manila at the same season of the year, has approximately the same, or even a greater effect, on guinea pigs and monkeys, as well as on human beings. The laboratory has begun an investigation of the changes in the blood brought about by exposure to the sunlight and is obtaining interesting results. The work, so far as it has gone, will soon be published in the Philippine Journal of Science.

The continuation of the work on compounds which cause the red coloration of aniline showed the cause for the coloration of that substance to be in the production of azobenzene, 2,5-dianilinoquinone, dianilinoquinoneanil, and azophenene.

The laboratory of organic chemistry has also brought to completion and published in the Philippine Journal of Science the first portion of a series of papers on the alcohol production in the Islands. The first article, which has already gone to press, covers the production of alcohol from palm-saps and shows that in the nipa palm the Philippine Islands possess the cheapest source of industrial alcohol in the world.

The possibilities of the production of cane-sugar from palm saps are considered, also, and it is shown that the commercial preparation of sugar from the nipa palm is attractive.

The work on the separation of alkaloids by the formation of periodides has been continued and it has been shown that the amount of additive iodine varies within wide limits according to the active masses of the various reagents. A paper on this subject has been published in the Philippine Journal of Science. The study of the hydrolysis of methyl salicylate, begun two years ago, has been continued.

During the year, as opportunity offered, a study has been made of the value of Philippine woods for destructive distillation. The work on Philippine tan-barks has been completed and published.

It shows that the mangrove swamps of the Philippines, although less extensive than those of Borneo, are adequate as to the quality and the quantity of the bark they can furnish to support at least one or two extract factories and it appears as if, under present market conditions and the advantage of free entry of Philippine cutch into the United States, there is an opportunity for a profitable industry.

Some improved methods of analyses of distilled liquors were developed and described during the year.

The distillation of Manila copal gave the following: resin oil, pinene, beta pinene, limonene, dipentene, camphene, water, formic and acetic acids, methyl alcohol, acetone, acetyl formaldehyde, formaldehyde, furaldehyde, carbon dioxide, saturated and unsaturated hydrocarbons, and probably acrolein. It was also shown that organic peroxides were formed by the oxidation of Manila copal.

The work on Philippine essential oils, especially those derived from the champaca, was continued and practically completed. This work is rather too intricate for a brief review, but the details will shortly appear in the Philippine Journal of Science.

THE DIVISION OF MINES.

The changes in the staff of this division during the past year have been as follows: Mr. H. G. Ferguson, who went to the United States on leave on June 4, 1910, resigned on March 15, 1911; Dr. George I. Adams resigned on August 6, 1910; Mr. F. A. Dalburg, a surveyor in the Bureau of Lands, educated as a coal engineer, joined the division on September 4, 1910. One vacant position exists in the division of mines. An arrangement has been made with the dean of the college of letters and science of the University of the Philippines by which the instructor in geology will devote the greater part of his mornings to petrographic work. However, this work is more in the nature of study than of direct assistance to the Bureau. On June 30, 1910, the assay work of the Bureau was transferred from the division of chemistry to the

division of mines and placed under the charge of Mr. Paul R. Fanning. During the past year ₱3,303.80 worth of work has been done in that laboratory. The apparatus for testing road material has been transferred to the division of general, inorganic and physical chemistry and put under the charge of Mr. Reibling.

The past year has shown a marked change in the conditions governing this division, as the general public has begun to insist on the services of its members for surveys of properties and the study of projects. This is clear from the following statement of such work performed for other departments of the Government, for private persons, or for the United States Army: Report on the United States Army mine on Batan Island, September, 1910; report on Catanduanes, September, 1910; report on the quarry of Hosty and Brown at Cavite, September, 1910; report on the Agno River placer in Pangasinan, September, 1910; report on the water supply of the hacienda of the Compañía General de Tabacos de Filipinas at San Carlos, Negros, November, 1910; report on the provincial quarry at Imus, Cavite, November, 1910; report on the San Mauricio mill, November, 1910; report on the oil lands of the Manila Mining Association and examination of the geology of the Peninsula of Tayabas, January, 1911; report on a new quarry site at Talim Island, La Laguna, January, 1910; report on a new quarry site at Angona, La Laguna, January, 1910; report on the mining properties in Pangasinan and geology of the region, March, 1911; an investigation of the cement materials around Cebu begun in March, 1911, and not yet completed.

Other field work accomplished by the division has been a coal inspection trip with the coal expert of the Government throughout the Archipelago and Borneo; a geological survey of Taal Island and the surrounding country, a report of which has been published; an inspection of the Baguio mineral district; and an inspection of progress in the Masbate District.

A member of the staff from November 10, 1910, to May 12, 1911, served as acting superintendent of the East Batan Coal Mine during the absence of the superintendent. The water in the mine was removed, a mine fire walled off, and the property kept in condition to be turned over to his successor.

The division of mines has prepared a complete model of a modern gold-milling plant, of mine sections, and relief models of all of the mining districts which were exhibited at the previous Carnivals and which are now to be seen at the museum and at the laboratory building. These models are continuously consulted by miners, prospectors, and school-children. Mine models are now frequently used in the United States in court during litigation.

Work, which had been inaugurated some time ago, was completed and made ready for publication during the past year. This includes the second section of the general Reconnaissance of Southeastern Luzon; the Geology of the Aroroy Mining District of Masbate; Parts II and III of the Geological Reconnaissance of Mindanao and Sulu; the Economic Geology and Mining of the Baguio District; and the Essential Features of the Geology of the Philippines. A monograph on the Tertiary fossils of the Philippines is not completed. The fourth annual bulletin of the mineral resources of the Philippine Islands was also finished during the year. This work is much more comprehensive than the previous ones.

From time to time there have been found in the Philippines fragments of the remains of larger mammals. Some fragments of a deer's teeth were discovered in a well boring at Pasig at a depth of 80 meters, and some shark's teeth were found in the tuff formation between Laguna de Bay and Manila. Recently, in the northern portion of Zambales Province at the termination of the mountain range, where the plains of Lingayen begin, a fossil tooth of an extinct young elephant, related to the Indian elephant, was encountered in the Pliocene or Pleistocene limestone of Kabaruyan Island off Bolinao Point. These indications possibly point to greater finds in the future and it will be very desirable, when opportunity occurs, to explore the last-named region. The importance of the careful study of the paleontology of a country is not generally recognized. The fossil forms of a number of the lower organisms bear a direct and intimate relationship to many of the deposits of economic value, so much so, indeed, that the occurrence of certain of these can be predicted accurately from the occurrence of such forms.

INVESTIGATIONS.

Taal Volcano.—A severe eruption of Taal Volcano occurred during the period from January 28 to February 2, which culminated in a violent explosion on the night of January 30. From the evidences at hand, it appears that the volcanic tuff from a large area in the bottom of the crater on Taal Island was ejected with extreme violence while, at the same time, the explosion produced an atmospheric disturbance manifested by an intense wind blast which radiated from the center of disturbance across the lake in all directions. This disturbance caused a wave which washed and inundated a large section of the low-lying shores of the lake. The area of destruction lay to the west and north of the volcanic center and at this point a shower of mud and ashes descended at places to a depth of more than a meter. Beginning on January 29, repeated earthquake shocks were felt, most severe in the area surrounding the mountain, and a considerable displacement occurred along the fault line from the town of Lemery on the coast up to the Lake of

Taal; this reappears on the other side at Talisay and probably marks a line which ended somewhere in the neighborhood of Antipolo. A section of the territory between a line extending to the west of Taal and to the east of Lemery was markedly lowered by the two scarp lines, and certain new hot springs, or geyser-like formations, developed near the seacoast at the *barrio* of Simsian. The floor of the crater of Taal was lowered by reason of this explosion and the ejecting of material, and the water from the lake began to pour in until finally a new lake, which covered more than the total area formerly occupied by the various colored lakes appearing on the map of Taal, was formed. The island also sank more than 3 meters in places. Experience has shown that the islands within the lake are unsuited for human habitation; that probably an area along its boundaries, marked by a circle having the crater for its center and extending in radius 13 kilometers outward so as to include the point of greatest destruction, is not advisable for habitation, but might be used for the raising of crops if the farmers lived at a distance. The town of Lemery is also in a position on the main scarp line and, therefore, always will be subject to subsidence. It would be advisable gradually to remove the inhabitants from this point. The eruption of Taal was carefully studied and a detailed account published in the Philippine Journal of Science.

Bricks.—Building and road materials are of great importance and during the past year the division of mines has paid more attention than ever to this question. The making of a suitable brick in Baguio is of especial interest and investigations, having for their end the discovery of such materials, were carried on. A siliceous sinter occurs in large quantities in Baguio, evidently deposited by the past action of hot and silicified waters. A small example of what was probably going on on a large scale is still to be found in the hot springs of Itogon, in those along the lower part of the Benguet road about 3 kilometers above Camp One, in Daklan, at Tublay, and in other places. The division of general, inorganic and physical chemistry has shown that this siliceous sinter contains about 94 per cent of silica and, if mixed with lime and a certain proportion of crushed stone, pressed into forms and steamed at 75 kilograms, forms bricks having a resistance to breaking of 519 kilograms per square centimeter. It would seem as if this problem should be followed out more completely, but in order to carry on the work on a scale which would give an indication of its commercial value a larger brick-making machine would need to be purchased. The entire question, together with samples of the brick, was referred to the Honorable, the Secretary of the Interior on June 5, 1911. It is a well known fact that bricks of this nature are being manufactured in other parts of the world and that the preparation of sand-lime bricks is a rapidly increasing industry.

Enrichment of ores.—While the division of mines was in Baguio, it was not only occupied with the attempt to locate materials for brick making but, basing its work upon the facts expressed above of the existence of large amounts of hot water containing mineral matter in solution, a study of the enrichment of ore veins from solutions was begun. This is a matter of great importance to the miners, as the result of this study may lead to a better comprehension of the question of the enrichment of ores with depth and to a better view of the commercial means which should be undertaken to extract these from the various mines. It has been shown by W. H. Emmons, United States Geological Survey, that ore deposits bearing manganese become richer with depth, owing to the combined action of water, higher oxides of manganese, the chlorine from the salt, and the sulphides of iron, but that where no manganese occurs enrichment does not always take place. The question of the geology of the Baguio mineral district and the problem of some of these changes so far as they have been studied will be published in a more complete form in the near future.

It will be desirable to continue the geological work of the Benguet mineral regions beyond the area at present mapped, but to do this a topographical survey would first be necessary. It has always been the attitude of the Director of this Bureau that employees of the division of mines should primarily devote themselves to geology and mining and should not have their time taken by the preliminary topographical surveys. However, careful work in geology and mining is not possible without such topographical surveys and it is again urged that some appropriation be made to the Bureau of Lands to carry on these surveys in regions where it is most necessary to continue geological work.

Coal.—The coal of the Philippine Islands as it is now being mined might possibly best be used in the form of briquets to prevent the extensive decrepitation when it is burned. Briquetting materials to be used here must be of native origin and sufficiently cheap so as not unduly to increase the price of briquetting. Starch has been suggested for a binder, but as yet the Philippine Islands do not furnish starch in abundance or cheaply. The cassava would be a real source of cheap starch if it were planted extensively, but as yet this is not the case. However, we have in *tiqui-tiqui*, which is the native name for the polishings from rice, a material which seems well fitted for the formation of briquets. Our apparatus is very primitive as we are confined to the small presses at hand. The preliminary work in the making of such briquets indicates that in *tiqui-tiqui* we have a good binder and that the briquets burn without disintegrating.

It is well again to call attention to the Sibuguey coal field which is twelve hours' steaming from Zamboanga on the Sibuguey River. According to a report on some specimens which have been secured, this

coal apparently forms a hard, coherent coke of good grade. It is believed that drilling at indicated points on this peninsula will show a higher grade, possibly an anthracite, which may be formed as a result of the great compression to which the strata in this region have been subjected. A semianthracite coal, having a carbon content of 82 per cent, was located near the Tres Reyes Peaks on Dumanquilas Bay.

Manganese ore has been discovered in quantity which would seemingly be commercially profitable in the Philippine Islands in Pangasinan and Masbate. It seemed possible to develop this industry, but when the matter was looked into it appeared that an export wharfage charge of ₱2 per ton exists on all kinds of ore. Manganese ore would probably bring in the neighborhood of ₱13.00 per ton in Japan for the best grade. If the ore is taken in ballast to Japan, this charge would not be serious, but if it were shipped to the west coast of America, where a freight rate of ₱10.00 a ton would be reasonable, adding the ₱2.00 for wharfage charge, there would remain only ₱1.00 for the work of mining and the profit. The same is true in regard to iron ore. A geologist from Japan in the employ of the Mitsui Bussan Kaisha, examined the iron deposits on a small island in Mambulao Bay in Ambos Camarines where iron ore occurs in considerable quantity. It would bring, at the best, ₱4.50 in Japan, a royalty of ₱0.50 would have to be paid to the persons owning the land, ₱2.00 a ton would have to be paid for export dues, which would leave only ₱2.00 for the expenses of mining and the profit. It is recommended that as soon as possible the law be altered, remitting these export dues.

It would be to the advantage of all concerned in mining operations in the Philippines if all data in regard to these operations could promptly be transmitted to the Bureau of Science. It is the desire of the Bureau not only to give an accurate account of the possible mineral resources of the Philippines in its annual bulletin, but it is also very necessary for the information of persons in other countries who may be interested to give as accurate and conservative an account as possible of existing operations. If only partial data are available, this account can by no means be complete and therefore the entire country suffers. The bulletin of mineral resources reaches all parts of the world and it would seem as if all who were engaged in the mining industry would be interested in placing the exact facts regarding all properties before those who may be interested in them.

THE DIVISION OF ETHNOLOGY.

Mr. Christie returned from the United States in September, 1910, after having spent a considerable part of his leave in studying ethnology at Harvard University. Mr. John M. Garvan, a temporary employee in this division, left Manila in March, 1911, for Surigao to attend to some private business and he has not yet returned.

Improvement in the museum has steadily continued. Four new sloping-top and two flat-top cases have been installed on the lower floor and two upright ones have been placed on the upper. All but one of these have been received recently and have not yet been filled with exhibits. One will be devoted to an exhibit of Philippine silk, showing the various stages of manufacture from the cocoons to the woven silk. Forty-three specimens of porcelain made in the Philippines were added to the museum, through the kindness of Mr. E. Zobel of Manila. This collection includes large and small vases, plates, cups and saucers, bowls, water bottles, and electrical fixtures. An interesting collection of crude rubber, which was brought from Singapore by Mr. A. W. Prautch, was purchased by the museum and has been installed temporarily in one of the old upright cases. Some months ago a collection of sponges from Japan was presented to the museum. These have recently been mounted and placed on exhibition.

The collection of hats has been increased by 11 specimens and for the ground which it covers is now fairly complete. However, there are a number of other hats made in the Philippines which are not of commercial importance, but which should be included in a collection illustrative of the ethnology of the Archipelago. These will be added from time to time as materials become available. Mr. Beyer, upon his return from work among the Ifugao people, brought with him a large collection which he had gathered, and he also caused to be shipped those articles which the lieutenant-governors of the various mountain subprovinces had collected at the request of the Bureau; these have been added to the collections. A small amount of Manyan material has also been brought in by Doctor Miller. Mr. Seale has added a collection of native fish-traps and Mr. Martin has completed 32 colored transparencies illustrating various phases of Philippine life. The Bureau of Forestry has made steady improvement in its exhibits and is constantly adding new specimens of the forest products of the Philippines.

A committee was appointed in February, 1911, to act for the recently appointed Exposition Board in selecting from the various provincial exhibits at the Carnival articles for a permanent Philippine museum. This committee was made up of representatives of the Bureaus of Agriculture, Forestry, Education, and Science. Thirty-six of the articles selected by the committee are now in the museum. Others are with the Bureau of Agriculture. The specimens in the museum include samples of hemp and maguey, models of sugar and rice mills and of vehicles, together with some carved wood and engraved silver. The commercial exhibit has been increased steadily as opportunity offered, and the need of making the collection representative of the commercial products of the Islands has been urged at every opportunity.

The following have been the accessions of the museum during the fiscal year 1911:

New numbers used and cards made, 2,636-4,937 (inclusive), totaling 2,302 specimens, distributed as follows:

1. Manobo, Mandaya, and Mangguangan (3001-3466, 3510-3528, 3531-3598).	
Total, 553 specimens.	
Collected by Mr. John M. Garvan	453
Collected by Dr. Merton L. Miller	35
Collected by Governor Frederick Johnson	27
From St. Louis Exposition, and miscellaneous sources	38
2. Ifugao (3968-4800). Total, 833 specimens.	
Collected by Mr. H. Otley Beyer	703
Collected by Mr. Leoncio Molano	130
3. Mangyan (3467-3468, 4878-4937). Total, 62 specimens.	
Collected by Dr. Merton L. Miller	60
From miscellaneous sources	2
4. Batanes Islands (3469-3509). Total, 41 specimens.	
Presented by Mr. Otto Scheerer	41
5. Moro (3529-3530, 4832). Total, 3 specimens.	
Collected by Dr. Merton L. Miller	2
Collected by Mr. Emerson B. Christie.....	1
6. Kaiyapa Igorot (3935-3952). Total, 18 specimens.	
Collected by Mr. H. Otley Beyer	18
7. Isinai (3953-3963). Total, 11 specimens.	
Collected by Mr. H. Otley Beyer.....	11
8. Iloco (3964-3967). Total, 4 specimens.	
Collected by Mr. H. Otley Beyer	4
9. Philippine pottery (4801-4822, 4824-4841, 4843-4865). Total, 63 specimens.	
Presented by Mr. E. Zobel	63
10. Commercial hats (2636-2789, 4867-4877). Total, 165 specimens.	
Collected by Dr. C. B. Robinson	108
From St. Louis Exposition, and miscellaneous	57
11. Bagobo (4842). Total, 1 specimen.	
Presented by Miss Laura E. W. Benedict	1
12. Miscellaneous specimens from St. Louis Exposition, and other miscellaneous sources, on hand in Museum for some time but now first catalogued (2790-3000, 3599-3934, 4866). Total, 548 specimens.	
From St. Louis Exposition, and miscellaneous	548
Total	2,302

On February 1, 1911, the Bureau sent a representative to Zamboanga with an exhibit for the fair of the Moro Province, this exhibit having been requested, especially, by the authorities at Zamboanga. Photographs of many people belonging to the various tribes of the Moro Province were made at this time by the assistant photographer of the Bureau.

The Bureau has long had in view an investigation of the peoples adjacent to the Mountain Province, with especial reference to their industries, languages, and customs. This is in line with the recommendations made in the annual report of the Director of the Bureau of Science in the year 1907. In pursuance of this plan, Mr. Christie in March, 1911, left for Vigan to begin a study of the Iloco people. He first devoted his attention to the language, in order to facilitate his further work. He returned to Manila in May, taking one month's leave; he was in charge of the museum during the absence of the chief of the division in Mindoro, and has now returned to Vigan. It is expected that he will procure a representative collection for the museum as well as material for a most interesting monograph.

The work in Ifugao Subprovince begun by the division was completed in October, 1911, and Mr. Beyer returned to Manila, bringing his extensive collections with him. During this work he traveled widely and checked the majority of the data which he had gathered during his previous residence among the people of that region. Some information about other tribes, neighbors of the Ifugao, was also obtained. The time from October to February was spent in arranging this collection for the museum, labeling and cataloguing, and in beginning the work on a monograph of these peoples soon to be issued. A part of February and March was again spent in the Ifugao country perfecting some notes previously obtained and work on a monograph on the subject has been pushed. The chief of the division of inorganic and physical chemistry made a trip to the Ifugao country to secure specimens from the hot and mineral springs which occur in that region and in this work he was assisted by Mr. Beyer of the division of ethnology.

All material collected in the work among the Mandayas has been catalogued and exhibited. The manuscript of the monograph on these people is to a large extent completed and has been copied. Mr. Garvan is expected to return in August and will finish his publication.

Some work was done in Davao in October, 1910, during the vacation period of the chief of the division and some additional time was consumed in visiting the Mandayas of the Tagum River at the head of the Gulf of Davao. On April 5, the division began work in Mindoro among the Mangyans for the purpose of studying the conditions under which they live. This work continued until it was terminated by the rains. During the greater part of the time, the chief of the division was accompanied by Governor Franks, of the Province of Mindoro, and, in company with him, he crossed the Island of Mindoro.

The Mangyans near Bulalacao, Abra de Ilog, Bacó River, and Lake

Naujan were visited. Vocabularies of 100 or more words were collected at several places. A very thin and scattered population of Mangyans was encountered. Owing to the fact that the population is so thin and so scattered and that the people for the greater part live in places not easy of access, the problem of improving their condition is somewhat difficult. The work in Mindoro will be resumed as soon as weather conditions will permit; meanwhile a preliminary publication on the subject of the Mangyans is being prepared. In addition to the work just mentioned, the division has in preparation a paper on the Lepanto Igorot, one on an Ifugao burial ceremony, and one on the use of tapa and woven bark clothing.

Mr. F. C. Cole, of the Field Museum of Chicago, left Manila for Davao in July, 1910. He visited various tribes in that district until January, 1911, and prepared an article for publication in the Philippine Journal of Science. However, he became seriously ill and left for the United States.

The museum has practically reached the limit of the capacity of the present building. Collections added from now on will crowd it unduly. Nevertheless, the collections will steadily be increased as members of the division go into the field and have opportunities for securing specimens.

THE LIBRARY.

Miss Mary Polk, librarian, went on leave on July 12, 1910. Mrs. B. T. Brooks, acting librarian, resigned on March 22, 1911, and Miss E. E. Kinne was appointed in her place. Miss Huldah E. Kupfer returned to the Bureau on April 1, 1911, and was assigned to the library.

A new charging system, by which a greater number of people may be accommodated in a given time with greater ease and accuracy, was installed during the year. This does away with the old method of using memorandum receipts, and books which are out can be located at once. Before this was done, the library was checked with the shelf-list, which dates from January 14, 1908, and only 18 bound volumes were found to be missing. Four of these have since come to light.

The revision of the list of current serials was placed in such shape that it can be used as printer's copy. It gives the source of receipt for each journal whether by purchase, exchange, or gift. The serial record cards have been copied, and this information embodied on the back. The work of claiming missing numbers of these serials was also steadily pushed and we have probably made better progress in this direction than ever before.

Accessions.—Bound volumes to the number of 2,413 were added during the past year; 1,417 by binding, and 996 from all other sources.

Some of the more important works and sets included in this work are:

- Globus, v. 1-94.
- Zeitschrift für Heilkunde, v. 1-24 in 34 v.
- Der Tropenpflanzer, v. 1-11.
- Thurston. Castes and Tribes of Southern India, 7 v.
- Oppenheimer. Handbuch der Biochemie des Menschen und der Tiere, 4 v.
- Physikalisch-chemisches Centralblatt, 6 v.
- Prager medicinische Wochenschrift, 11 v.
- Tijdschrift voor Entomologie, 34 v.
- Linnean Society, Journal, Zoology, 28 v.
- Linnean Society, Proceedings, 9 v.
- Boehmer. Bibliotheca Scriptorum Historiae Naturalis, 1785-1789, 9 v.
- Biochemische Zeitschrift, 15 v.

By gift from Dr. Pardo de Tavera, the library came into the possession of certain rare and valuable books, particularly those on the drugs of India. By the will of Dr. David J. Doherty, of Chicago, we have received a number of volumes of special interest to students of history and etymology in the Philippine Islands.

Classification and cataloguing.—The work of this department compares favorably with the previous year, showing 3,003 bound volumes and 8,014 unbound volumes and parts classified and shelf-listed, and 1,195 cards added to the shelf-list. In addition to the new books, which have been added and classified, this number includes many volumes which were out on old memorandum receipts, and which were recalled for the purpose of classification. Classes H, Social sciences, and J, Political science, have been entirely reclassified, as only a tentative arrangement was possible before the printed scheme was received. Class D, History other than United States, will have to be done over, for a similar reason, when the printed scheme is received from the Library of Congress. Class GN, Anthropology, will need reclassification also, as the printed scheme differs materially from the typewritten one which was used originally. Section QE, Geology, and some of the United States government documents have been classified, and practically all of the Philippine government documents and reports are now on the shelves.

Binding.—Much time has been given to binding, with the result that nearly all of the old serials are now bound and new volumes are being sent out as soon as complete. During the year, 1,650 volumes have been sent to the bindery and 1,327 have been returned. Of this number, 200 volumes were sent to the bindery prior to July 1, 1910, which leaves 523 volumes still there. Much remains to be done in this line, and the time of one assistant might well be given over to this work almost entirely.

Circulation.—With the new charging system in working order and the records posted daily, it is possible to have accurate data as to the

circulation of material from the library. Each class of books is entered separately, with totals for each class and each day. The average circulation for a month since January was 565 with a daily average of 19.

The average number out at the end of each month was 2,849; with a total number of issues since the installation of the system of 5,274.

Use of the library.—The figures for circulation are encouraging, but do not convey an accurate idea of the extent to which the library has been used. Readers from practically all of the Government bureaus have been accommodated, in addition to the service rendered the workers of the Bureau of Science. Many persons not connected with the Government have found material available for their purposes. With the readjustment of the working force, the reading room and tables have been practically free from routine work.

The stacks are now so full that it has become a serious problem as to how to shelve the books which are in constant use. The library space in the new wing will relieve this situation before the end of this calendar year.

The transfer of the duties of the acting librarian interrupted the progress of the work to a certain extent, while two new and untrained workers required considerable time for instruction. The departure in June of a Filipino worker, who has been in the library for three years, has made a perceptible difference in the present working capacity of the force, but this loss will soon be redeemed as the additional workers gain experience. The Filipino helpers are gradually obtaining a grasp of the subject, and are promising well for capacity to occupy positions of trust and responsibility in the library.

THE ENGINEERING DIVISION.

The Director of the Bureau, during the year, transferred the direct supervision of the power plant to the chief of the division of general, inorganic and physical chemistry; Mr. José Guerrero y Reyes remaining as chief engineer and Mr. F. Y. Ycasiano as assistant engineer. Many changes have been made, owing to the completion of the Philippine General Hospital and the College of Medicine and Surgery. The Bureau of Public Works has installed connections between the Philippine General Hospital, the main building of the College of Medicine and Surgery, and the power plant of this Bureau. This includes the construction of a tunnel between the buildings; the erection of two tanks, heated by exhaust and live steam for the purpose of furnishing hot water to the hospital; the laying of steam, hot water, and gas pipes from the power units to all of the buildings concerned; and the placing of the necessary cables for electric current. A centrifugal pump, also, was placed in the tunnel to take care of the water entering by leakage. This system has now been operating for ten months and it is not yet perfect or complete. Effort will be made to call the attention of

the Bureau of Public Works to all defects, as they occur so that, in the course of time, the entire system will be on the most economical basis possible, with the least danger of a breakdown through accident.

The power plant has been in operation for twenty-four hours of each day, practically without interruption since September, 1910, and, therefore, the walls of the boiler furnace are gradually burning out and giving way without the possibility of cooling the boilers for repairs. It is imperative that an additional boiler unit be installed and ready for operation before these have to be replaced, and an order for this unit was placed by the Bureau of Public Works on July 12, 1911.

Philippine coals seem in every way suitable for the generation of producer gas and indications are that this is the most satisfactory method for their utilization. With the increased demand on our power plant, additional power is urgently necessary and the Bureau of Public Works has now ordered for us from the Gas-motoren Fabrik, Deutz, a 67-horsepower, Otto producer-gas plant, direct coupled with an electric generator to alternate with our present generators. It is expected that this unit will be installed within a few months and in readiness for experimentation with local coals.

The utilization of our low-grade and outcrop coals for producer gas seems extremely promising. It is anticipated that such a plant operating on the poorest grade of Philippine coal will be able to compete with the best steam plant in the Islands, especially in that it can burn successfully the slack and waste products which are not utilizable for steam purposes. It is probable that the poorest coals employed in a producer may even entirely replace the steam plant for stationary work. The installation of a producer-gas plant will not obviate the need of another boiler unit as it is necessary to supply hot water and steam from a boiler continuously and, therefore, all repairs to the present setting are impossible until an independent additional unit is in place.

No Americans are now employed in the power plant of this Bureau, and the engineers show great initiative and care in their work.

A table showing the cost of the production of current since the power plant has been in continuous operation is given below.

Month.	Cost per kilowatt-hour.
September	₱0.17670
October	0.15270
November	0.15138
December	0.14689
Calendar year 1911, January-June (inclusive)	0.13103

THE PHILIPPINE JOURNAL OF SCIENCE AND OTHER PUBLICATIONS.

Section D, Ethnology, Anthropology, and General Biology, of the Philippine Journal of Science, begun in 1910, was continued throughout that calendar year and has met with the approval of subscribers and ex-

changes. This section is continued with Volume VI, 1911, as General Biology, Ethnology and Anthropology. The publication of Section D permits a desired reduction in the size of Section A. A number of institutions and periodicals to which Section A was formerly sent are now receiving Section D instead and have indicated their satisfaction with this change.

The following is a list of articles printed in the Journal during the fiscal year, those by members of the staff of the Bureau of Science are marked by an asterisk (*), those by members of the College of Medicine and Surgery by a dagger (†).

Section A, Chemical and Geological Sciences and the Industries.—

*Richmond, George F., Philippine Fibers and Fibrous Substances: Their Suitability for Paper Making; *Bacon, Raymond F., Philippine Terpenes and Essential Oils, IV; *Bacon, Raymond F., A Preliminary Study of the Effect of Tropical Sunlight on the Atmosphere, with Some Notes on Radioactive Phenomena in the Philippines; *Bacon, Raymond F., A Solution of Oxalic Acid and Uranium Salts as a Chemical Photometer; *Smith, Warren D., The Essential Features of the Geology of the Philippine Islands; *Smith, Warren D., Geological Reconnaissance of Mindanao and Sulu. II. Physiography; *Reibling, W. C., and *Reyes, F. D., Physical and Chemical Properties of Portland Cement; *Gibbs, H. D., The Compounds Which Cause the Red Coloration of Aniline: II. The Effect of Sunlight in the Absence of Oxygen and Oxidizing Influences and a Comparison with the Behavior of Mono- and Dimethylaniline; *Brooks, B. T., The Natural Dyes and Coloring Matters of the Philippines; *Cox, Alvin J., Philippine Firewood; *Oechslein, K. J., Quinine Esters of Phenylarsinic Acid Derivatives; *Pratt, Wallace E., The Mechanical Analysis of Soil; *Williams, Robert R., The Economic Possibilities of the Mangrove Swamps of the Philippines; *Pratt, Wallace E., The Eruption of Taal Volcano; *Martin, Charles, Observations on the Recent Eruption of Taal Volcano; *Cox, Alvin J., The Composition of the Fine Ejecta and a few other Inorganic Factors of Taal Volcano; *Gibbs, H. D., The Alcohol Industry of the Philippine Islands. Part I.; *Reibling, W. C., and *Reyes, F. D., The Physical and Chemical Properties of Portland Cement. Part I; *Holmes, W. C., On the Formation of Certain Alkaloidal Periodides, Preliminary Investigation.

Section B, Medical Sciences.—†McLaughlin, Allan J., and †Andrews, Vernon L., Studies on Infant Mortality; McCay, D., The Relationship of Food to Physical Development; †Heiser, Victor G., Unsolved Health Problems Peculiar to the Philippines; Neeb, H. M., The Parthenogenesis of the Female Crescent Body; Shibayama, G., On Malaria Parasites of the Orang-outan; Atkinson, J. M., Malarial Fever during the Puerperium; Castellani, Aldo, Tropical Bronchomycosis. Observations on a New Species of Epidermophyton found in Tinea

cruris. A New Intestinal Spirillum; Castellani, Aldo, and Chalmers, Albert J., Note on an Intestinal Flagellate in Man; Hooton, A., Some Clinical Aspects of Mycetoma, An Unusual Form of Callosity Complicating it; Rogers, Leonard, The Prevention and Treatment of Amœbic Abscess of the Liver; †Musgrave, W. E., Intestinal Amœbiasis without Diarrhœa. A Study of Fifty Fatal Cases; †Stitt, E. R., A Quick, Simple, and Accurate Method of Making Differential Blood Counts in Wet Preparations and Its Advantages in the Diagnosis of Surgical and Tropical Diseases; Chamberlain, Weston P., A Statistical Study of Uncinariasis among White Men in the Philippines; Rissler, R. S., and *Gomez, Liborio, The Prevalence of Intestinal Parasites in Rizal and Cavite Provinces and in the Cagayan Valley; De Vogel, W. T., *Myzomyia rossii* as a Malaria Carrier; Dunbar, A. W., Antimalarial Prophylactic Measures and their Results at the Naval Station, Olongapo, P. I.; *Bowman, Fred B., The Incidence and Complications of Malaria in the Philippine Islands with Special Reference to its Treatment with Arsenophenylglycin; Brooke, Gilbert E., Notes on Contagious Ophthalmia; Perry, Sir Allen, The Present Position of the Leper in view of the Resolutions Passed at the International Conference on Leprosy at Bergen, 1909; †Musgrave, W. E., and †Sison, A. G., Tuberculosis among Filipinos. A Study of One Thousand Cases of Phthisis; †Musgrave, W. E., and †Sison, A. G., Blood Pressure in the Tropics. A Preliminary Report; Brewer, Isaac W., Tuberculosis in the Philippine Islands; †Musgrave, W. E., and †Sison, A. G., Mali-Mali, a Mimic Psychosis in the Philippine Islands. A Preliminary Report; *Sellards, Andrew Watson, Tolerance for Alkalies in Asiatic Cholera; †McLaughlin, Allan J., and Sellards, Andrew Watson, Effect of the Concentration of Solution in the Treatment of Collapse in Asiatic Cholera; †Aron, Hans, The Chemical Composition of the Blood in Asiatic Cholera; †McLaughlin, Allan J., and Whitmore, Eugene R., Cholera and Cholera-like Vibrios Encountered in the Philippines; Strong, Richard P., The Specific Cure of Yaws with Dioxydiamidoarsenobenzol; Dudley, F. W., and *Whitmore, E. R., Hydrophobia in the Philippines; Lefebvre, M., Researches on Acarids among Lepers; †Clark, Elbert, On the Occurrence of an Accessory Naso-Frontal Duct of the Frontal Sinus; Bowman, Fred B., A Note on the Spontaneous Occurrence of Bacillary Dysentery in Monkeys; Bowman, Fred B., Complement Fixation in Yaws; Willets, David G., A General Discussion of Pellagra, with Report of a Probable Case in the Philippine Islands; Chamberlain, W. P., Bloombergh, H. D., and Kilbourne, E. D., Examinations of Stools and Blood among the Igorots of Baguio, Philippine Islands; Tribble, G. P., Unidentified Larvæ of Some Dipterous Insect Developing in the Deep Urethra and Bladder of Man Producing Severe Abdominal Symptoms; Phalen, James M.; An Experiment

with Orange-red Underwear; †Shaklee, A. O., Treatment of Strychnine Poisoning with Chloroform; †Musgrave, W. E., and †Sison, A. G., The Bone Lesions of Small-pox; *Whitmore, Eugene R., and *Clegg, Moses T., The Specific Treatment of Leprosy; *Whitmore, Eugene R., Tuberculosis in the Philippines; Final Result of One Year's Specific Treatment of Eighty Cases of Pulmonary Tuberculosis; *Whitmore, Eugene R., Further Observation on Therapeutic Inoculations of Bacterial Vaccines; †Aron, Hans, Nutrition and Growth: I; *Sellards, Andrew Watson, and †Shaklee A. O., Indications of Acid Intoxication in Asiatic Cholera; *Willets, David G., A Statistical Study of Intestinal Parasites in Tobacco Haciendas of the Cagayan Valley, Philippine Islands; Boynton, W. H., A Note upon Anthrax in the Philippine Islands; †Aron, Hans, Investigation on the Action of the Tropical Sun on Men and Animals; Chamberlain, Weston P., The Eradication of Beriberi from the Philippine (Native) Scouts by Means of a Simple Change in Their Dietary; *Bowman, Fred B., A Case of Dysentery Caused by *Balantidium coli* with Coincident Filarial Infarction of the Spleen; *Ruediger, E. H., Some Observations on So-called Flagellates, Ciliates and Other Protozoa Encountered in Water and in Human Stools (Preliminary Report); *Garrison, Philip E., *Davainea madagascariensis* (Davaine) in the Philippine Islands; Chamberlain, Weston P., Bloombergh, Horace D., and Kilbourne, Edwin D., A Study of the Influence of Rice Diet and of Inanition of the Production of Multiple Neuritis of Fowls and the Bearing Thereof on the Etiology of Beriberi; †Stitt, E. R., A Study of the Intestinal Parasites found in Cavite Province; *Whitmore, Eugene R., The Dysentery Bacillus with a Bacteriologic Study of an Epidemic of Bacillary Dysentery in the Philippines; †Heiser, Victor G., Practical Experience with Beriberi and Unpolished Rice in the Philippines; Hooton, A., Perineal Litholapaxy. (Keith's Operation); *Gomez, Liborio, A Clinical Study of Hookworm Infection in the Philippines; Chamberlain, Weston P., and Vedder, Edward B., A Contribution to the Etiology of Beriberi.

Section C, Botany.—Merrill, E. D., An Enumeration of Philippine Leguminosae, with Keys to the Genera and Species (concluded); Brothcrus, V. F., Contributions to the Bryological Flora of the Philippines, III; Sydow, H. et F., Fungi Philippinensis; Merrill, E. D., New or Noteworthy Philippine Plants, VIII; *Merrill, E. D., Index to Philippine Botanical Literature, VI; Gamble, J. Sykes, The Bamboos of the Philippine Islands; Copeland, Edwin Bingham, Additions to the Bornean Fern Flora; *Merrill, E. D., and Merritt, M. L., The Flora of Mount Pulog; *Merrill, E. D., and Merritt, M. L., The Flora of Mount Pulog (concluded); De Candolle, C., A Revision of Philippine Piperaceae; *Robinson, C. B., Philippine Urticaceae; *Robinson, C. B., Philippine Urticaceae (continued); Ames, O., Notes on Philippine

Orchids with Descriptions of New Species, III; Kükenthal, G., *Conspetus Cyperacearum Insularum Philippinensium*; Cyperaceae-Caricoideae; Copeland, E. B., *Papuan Ferns Collected by the Reverend Copland King*; *Robinson, C. B., *Philippine Hats*; Copeland, E. B., *Bornean Ferns Collected by C. J. Brooks*; Copeland, E. B., *New or Interesting Philippine Ferns*, V; Foxworthy, F. W., *Philippine Gymnosperms*; *Foxworthy, F. W., *Bedaru and Villian*; *Two Important Borneo Woods*; Radlkofer, L., *Sapindaceae Novae Philippinarum Insulae Polillo*; *Robinson, C. B., *Botanical Notes upon the Island of Polillo*.

Section D, Ethnology, Anthropology and General Biology.—*Seale, Alvin, *The Fishery Resources of the Philippine Islands, Part III. Pearls and Pearl Fisheries*; *McGregor, Richard C., *Birds Collected in the Island of Polillo, Philippines*; *Seale, Alvin, *Descriptions of Four New Species of Fishes from Bantayan Island, Philippine Archipelago*; Forel, A., *Fourmis des Philippines*; *Banks, Charles S., *A New Accessory for Dissection Work*; *McGregor, Richard C., *Birds from Pauai and Mount Pulog, Subprovince of Benguet, Luzon*; Weise, J., *Verzeichniss von Coleopteren aus den Philippinen, nebst zwei neuen Arten aus Niederländisch Ostindien*; †Griffin, Lawrence E., *The Pearl Fishery of Bantayan*; *Seale, Alvin, *The Successful Transference of Black Bass into the Philippine Islands, with Notes on the Transportation of Live Fish Long Distances*; *Schultze, W., *Contributions to the Lepidopterous Fauna of the Philippines*; Moser, J., *Neue Coleoptera Lemellicornia von den Philippinen*; †Bean, Robert Bennett, *Filipino Ears, II: Ears from Malecon Morgue*; *McGregor, Richard C., *Additional Notes on Birds from Northern Mindanao, Philippine Islands*; *McGregor, Richard C., *Note on the Migration of the Tic-Wee Buzzard in the Philippine Islands*; *McGregor, Richard C., *Philippine Ornithological Literature, III*; †Griffin, Lawrence E., *A List of Snakes from the Island of Polillo, P. I., with Descriptions of a New Genus and Two New Species*; *McGregor, Richard C., *Birds from the Coast of Northern Luzon and from the Islands of Sabtan and Dalupiri*; Weise, J., *Ueber Chrysomeliden and Coccinelliden der Philippinen*; Ohaus, Fr., *Die Ruteliden der Philippinischen Inseln*; *Seale, Alvin, *Fishes of Borneo, with Descriptions of Four New Species*; †Griffin, Lawrence E., *Euplotes worcesteri* sp. nov.: I. Structure; †Griffin, Lawrence E., *Euplotes worcesteri* sp. nov.: II. Division; *Miller, Merton L., *The Burial Mounds of Camiguin Island*; †Bean, Robert Bennett, and Planta, Federico S., *The Men of Cainta*; Strohmeyer, H., *Borkenkäfer der Philippinen*; Curl, Holton C., *Notes on the Digestive System of Hydrocorax*; *McGregor, Richard C., *Notes on a Collection of Birds from Northern Negros*; Scheerer, Otto, *On a Quinary Notation among the Ilongots of Northern Luzon*; †Bean, Robert Bennett, *Filipino Ears, III. Negrito*; Douvillé, Henri, *Les Foraminifères dans le Tertiaire des*

Philippines; Barton, Roy Franklin; The Harvest Feast of the Kiangnan Ifugao; Cole, Fay Cooper; The Bagobos of Davao Gulf; Shufeldt, R. W., The Skeleton in the Flying Lemurs, Galeopteridae.

The exchange and free lists of the Journal have been gone over with the idea of removing addresses from which no returns are secured. Also, an attempt is being made to obtain increased results from copies of the Journal sent to other periodicals for review.

A paper on Philippine Hats by C. B. Robinson, and printed in the botanical section of the Journal, has been issued as a sales publication. A Manual of Philippine Silk Culture by Charles S. Banks has been sent to the printer and will appear as a sales publication.

The business manager of the Journal had many duties which were not at all directly related to the business management, and in trying to perform them all creditably he was greatly handicapped. This difficulty has been corrected by the appointment of Mr. R. C. McGregor as assistant to the editor of the Journal. He has taken over many of the duties connected with the administration of the Journal and other Bureau of Science publications which were not properly related to the business management and has left the business manager free to devote his time to the building up of the subscription list and advertising the various publications.

The assistant to the editor and the business manager are able to coöperate successfully in many matters pertaining to the Journal and other publications.

The mailing list of the Journal now comprises seven hundred and twenty-two names. Two hundred and seventy-six of these are paid subscriptions, three hundred and forty are exchanges, seventy are for review and thirty-six are free copies. It will be seen, therefore, that the actual paid subscriptions to the Journal are not great in number, but there is every reasonable expectation that they will increase several fold with proper attention.

On the 1st of April the outstanding accounts amounted to ₱3,128.00. This amount has been reduced by a little more than half, there being yet outstanding of these old accounts the amount of ₱1,527.65. Of this latter amount, however, ₱1,092.78 is made up by agents' accounts on which collection can not be pressed. For the quarter beginning April 1 and ending June 30, credit has been extended in the amount of ₱535.92. Thus, the total outstanding accounts on July 1, 1911, amount to ₱2,063.57, more than half of which is owing by agents who pay only at certain long intervals.

The total receipts from the Journal for the fiscal year 1910-1911 have been ₱3,574.45 as against ₱3,080.22 for the previous fiscal year. The value of the exchanges is approximately ₱4,760, making ₱8,334.45

in all. The cost of printing the Journal during the fiscal year just closed was ₱14,150.62, with ₱1,125.40 additional for reprints. Wrapping paper, twine, etc. cost ₱205.68. It is estimated that the time of those employees working on the Journal either a part or all of the time, amounted to ₱9,124.00 for the fiscal year. Thus the total cost of getting out the Journal for the fiscal year 1911, exclusive of postage, would be approximately ₱24,605.70.

The value of other publications of the Bureau of Science sold during the fiscal year 1910-1911 was ₱2,303.67 as against ₱1,036.62 for the previous fiscal year. In all, therefore, the Bureau has taken in ₱5,878.12 from sales of its publications in 1911, as against ₱4,116.84 in 1910, an increase of 35 per cent.

The Bontoc Igorot continues to be our best seller. There are no bound copies in stock and but a few of the paper-back edition remain. The Sugar Industry in the Island of Negros has sold well and the demand continues to be steady. Great hopes are entertained for the new publication on the silk industry in the Philippine Islands, which will be issued shortly. An advertising letter announcing the early appearance of this publication has aroused a general interest.

A campaign for securing subscriptions to the Journal has been planned, and it is expected at least to double the paid subscription list during the coming year. A series of letters will be written to book sellers and subscription agents in every country, enclosing attractive advertising matter and inviting them to correspond with the idea of becoming our agents. While we would expect to make few, if any, new agents, the interest aroused and the advertising obtained by this method can not but help in securing new subscribers.

In addition to these letters other personal letters will be written to scientific men soliciting their subscriptions. A very neat and attractive advertising folder has been compiled by the assistant to the editor of the Journal, and this can be enclosed in the same envelope with the letter without increasing the postage to an amount greater than the ordinary letter rate. Further to reduce the expense of this advertising, it has been decided not to send sample copies until sufficient interest has been aroused to bring forth a request therefor.

THE CLERICAL DIVISION.

Mr. A. E. Southard was appointed chief clerk in the Bureau of Science on April 1, 1911, to succeed Mr. R. C. Redmayne, who resigned on that date. The most important work which was necessary, as soon as he had familiarized himself with his duties, was the remodeling of the filing system which had become cumbersome.

A new and adequate *system* was devised and the old files in the office

now gone through and filed according to the new system. This has proved an enormous task and has not yet been completed. Filing requires a high order of clerical efficiency and a knowledge of English which few Filipino clerks have as yet acquired. For this reason the chief clerk has given his personal supervision to the work, and as he has only such time as can be spared from his regular duties, the building up of the new system will necessarily be slow. Until such time as the old files are included in the new system it will not be possible to give the members of the staff of the Bureau of Science complete efficiency in the matter of securing promptly such records as they may call for.

An important step toward the Filipinization of the clerical force has been taken in making a Filipino the bookkeeper of the Bureau in place of an American employee who has been promoted to the position of property clerk. This was made possible by the resignation of Mr. A. D. Tanner, the former property clerk. His place has been filled by Mr. C. J. Stancliff, who will be the active property clerk and supervise, as much as need be, the work of the accounting office. It is hoped to abolish altogether the position, made vacant by the resignation of Mr. Tanner and the subsequent promotion of Mr. Stancliff. It will be possible to do this, but it may be necessary to increase the number of Filipino clerks by one. The native clerk who has been made bookkeeper must still take care of his former duties in addition to his new ones. To do this he must have an assistant and has been given one. There is no clerk available to take care of the former duties of this assistant. The appointment of a native stenographer has been authorized.

The automobile messenger service operated by the chief clerk's office was discontinued on June 30. The scheme was entirely successful as regards efficiency. The bureaus subscribing to it found it to be economical as well. However, due to the small number of bureaus subscribing, the cost to the Bureau of Science was greater than was justified by our needs. For this reason and for the additional one that the equipment in use needed to be replaced, it was decided to discontinue the service. However, it is hoped, now that the practicability of such service has been demonstrated, that either the Bureau of Posts or the Bureau of Public Works will continue it.

Tables showing the routine work performed and supplies manufactured and disposed of during the fiscal year 1910-1911 by the Bureau are attached. A financial statement showing the appropriation and how it was expended is also appended hereto.

PAUL C. FREER.

Director, Bureau of Science.

To the Honorable,

THE SECRETARY OF THE INTERIOR.

TABLE I.—Comparative table of routine work performed and supplies manufactured and disposed of during the fiscal year 1911, as compared with the fiscal year 1910, by number or quantity.

[July 1, 1911.]

Division of the Bureau.	Samples or units.		Decrease.	Increase.
	1910	1911		
General, inorganic and physical chemistry:				
Clays, soils, fertilizers, cements	3, 293	3, 724		431
Fuels, gases, petroleums, woods	5		5	
Waters	82	164		82
Weights and measures standardized	8, 416	1, 066	7, 350	
Calorimetric tests of fuels		3		3
Coal tests	8	5	3	
Coal analyses	24	27		3
Rocks and minerals	8	35		27
Metals and alloys	24	46		22
Tests of the compression, tensile, or transverse strength, of concrete, stone, mortar, rope, iron, steel, etc.		440		440
Miscellaneous	250	488		238
Total	12, 110	5, 998	6, 112	
Organic chemistry:				
Foods, alcohols, beverages, etc. (this item includes all samples received at the laboratory during the year; the special report of the pure-food section includes the number completed)	1, 020	1, 049		29
Urines, clinical and toxicological analyses, etc.	401	494		93
Oils, paints, pigments, etc.	61	127		66
Miscellaneous				
Total	1, 482	1, 670		188
Mines division:				
Assays	873	1, 525		652
Biological laboratory:				
Fæces	13, 910	14, 223		313
Sputum	1, 945	780	1, 165	
Blood	597	275	322	
Gonococci	16, 944	13, 997	2, 947	
Waters	343	360		17
Necropsies	378	238	140	
Miscellaneous	796	5, 772		4, 976
Total	34, 913	35, 645		732
Serum section of the biological laboratory:				
Vaccine virus (doses)—				
Prepared	3, 058, 752	3, 451, 436		392, 684
Disposed of	3, 154, 791	3, 274, 579		119, 788
Antirinderpest serum (cubic centimeters)—				
Prepared	9, 610, 832	5, 876, 000	3, 734, 832	
Disposed of	9, 485, 890	5, 451, 666	4, 034, 224	

TABLE I.—Comparative table of routine work, etc.—Continued.

Division of the Bureau.	Samples or units.		Decrease.	Increase.
	1910	1911		
Serum section of the biological laboratory— Continued.				
Plague prophylactic (cubic centimeters)—				
Prepared				
Disposed of		2, 250		2, 250
Mallein (doses)—				
Prepared	1, 369	473	896	
Disposed of	1, 038	585	453	
Diphtheria antitoxin (units)—				
Prepared	581, 000	234, 000	347, 000	
Disposed of	403, 000	291, 500	111, 500	
Tetanus antitoxin (units)—				
Prepared	290, 000	610, 250		320, 250
Disposed of	336, 500	525, 000		188, 500
Cholera prophylactic (cubic centimeters)—				
Prepared				
Disposed of		30		30
Anti plague serum (cubic centimeters)—				
Prepared				
Disposed of	30	690		660
Anticholera serum (cubic centimeters)—				
Prepared	7	800		793
Disposed of	60	1, 626		1, 566
Antidysentery serum (cubic centimeters)—				
Prepared	870	780	90	
Disposed of	1, 470	720	750	
Antityphoid serum (cubic centimeters)—				
Prepared				
Disposed of	130	15	115	
Tuberculin, human (cubic centimeters)—				
Prepared	134	570		436
Disposed of	219	536		317
Tuberculin, bovine (cubic centimeters)—				
Prepared	135	191		56
Disposed of	100	152		52
Antigonococcus prophylactic (cubic centimeters)—				
Prepared	187	187		
Disposed of	178	197		19
Antistaphylococcus prophylactic, aureus and albus (cubic centimeters)—				
Prepared	177	168	9	
Disposed of	431	188	243	
Normal horse serum (cubic centimeters)—				
Prepared	18, 610	11, 200	7, 410	
Disposed of	24, 068	12, 262	11, 796	
Normal ox serum (cubic centimeters)—				
Prepared				
Disposed of	350		350	

TABLE I.—*Comparative table of routine work, etc.*—Continued.

Division of the Bureau.	Samples or units.		Decrease.	Increase.
	1910	1911		
Serum section of the biological laboratory—				
Continued.				
Normal carabao serum (cubic centimeters)—				
Prepared				
Disposed of	660		660	
Normal salt solution (liters)—				
Prepared	548.5		548.5	
Disposed of	652.5		652.5	
Cholera vaccine (cubic centimeters)—				
Prepared	68		68	
Disposed of				
Dysentery vaccine (cubic centimeters)—				
Prepared	73		73	
Disposed of				
Typhoid vaccine cubic (centimeters)—				
Prepared	57		57	
Disposed of		9		9
Tuberculin vaccine (cubic centimeters)—				
Prepared		175		175
Disposed of		175		175
"A" serum for exophthalmic goitre (cubic centimeters)—				
Prepared		35		35
Disposed of				
"B" serum for exophthalmic goitre (cubic centimeters)—				
Prepared		200		200
Disposed of		10		10
Rabies vaccine (doses)—				
Prepared		404		404
Disposed of		279		279
Anthrax vaccine No. I. (cubic centimeters)—				
Prepared				
Disposed of		93		93
Anthrax vaccine No. II. (cubic centimeters)—				
Prepared				
Disposed of		90		90
Miscellaneous:				
Shop orders	234	210	14	
Photographs	11,336	21,194		9,858
Natural history specimens sold	23	598		575
Miscellaneous work, etc	85	45	40	

TABLE II.—Comparative table of routine work performed (free and cash) and supplies manufactured and sold during the fiscal year 1911, as compared with the fiscal year 1910, by value.

[July 1, 1911.]

Division of the Bureau.	1910	1911	Decrease.	Increase.
General, inorganic and physical chemistry:				
Clays, soils, fertilizers, cements.....	P5, 858. 50	P5, 809. 50	P49. 00	
Gases, petroleums, woods, fuels.....	51. 00	540. 00		P489. 00
Waters.....	1, 465. 00	2, 485. 00		1, 020. 00
Weights and measures, standardization.....	4, 338. 00	589. 00	3, 749. 00	
Calorimetric tests of fuels.....		105. 00		105. 00
Coal analyses.....	380. 00	497. 25		117. 25
Rocks and minerals.....	188. 00	266. 00		78. 00
Metals and alloys.....	161. 00	309. 00		148. 00
Tests of the compression, tensile, or transverse strength, of concrete, stone, mortar, rope, iron, steel, etc.....		751. 26		751. 26
Miscellaneous.....	2, 180. 75	3, 785. 00		1, 604. 25
Total.....	14, 622. 25	15, 137. 01		514. 76
Organic chemistry:				
Foods, alcohols, beverages, etc.....	15, 724. 00	10, 770. 00	4, 954. 00	
Urinés, clinical and toxicological analyses, etc.....	1, 503. 00	1, 571. 00		68. 00
Oils, paints, pigments, etc.....	588. 50	1, 895. 50		1, 307. 00
Total.....	17, 815. 50	14, 236. 50	3, 579. 00	
Mines division: Assays.....	2, 212. 75	3, 426. 05		1, 213. 30
Biological laboratory:				
Fæcus.....	124, 025. 00	136, 388. 00		12, 363. 00
Sputum.....	5, 934. 00	2, 340. 00	3, 594. 00	
Blood.....	1, 776. 00	1, 137. 00	639. 00	
Gonococci.....	541, 365. 00	41, 994. 00	499, 371. 00	
Waters.....	13, 120. 00	13, 531. 00		411. 00
Necropsies.....	11, 075. 00	5, 950. 00	5, 125. 00	
Miscellaneous.....	3, 640. 00	22, 214. 00		18, 574. 00
Total.....	700, 935. 00	223, 554. 00	477, 381. 00	
Serum section of the biological laboratory:				
Vaccine virus.....	31, 075. 85	31, 764. 27		688. 42
Antirinderpest serum bottling, standardizing, etc., only.....	27, 522. 85	11, 656. 66	15, 866. 19	
Mallein.....	705. 00	536. 70	168. 30	
Miscellaneous preparations.....	1, 149. 85	1, 878. 43		728. 58
Total.....	60, 453. 55	45, 836. 06	14, 617. 49	
Miscellaneous:				
Shop work exclusive of work done for this Bureau.....	115. 93	206. 92		90. 99
Photographic work.....	4, 656. 71	5, 878. 19		1, 221. 48
Natural history specimens sold.....	23. 00	261. 22		238. 22
Miscellaneous work, etc.....	2, 121. 69	1, 027. 56	1, 094. 13	
Supplies.....	1, 632. 59	2, 044. 34		411. 75
Sale of publications (cash only).....	3, 436. 10	5, 588. 50		2, 152. 40
Total.....	11, 986. 02	15, 006. 73		3, 020. 71
Grand total.....	808, 025. 07	317, 196. 35	490, 828. 72	

TABLE III.—Comparative table of cash receipts for the fiscal year 1911, as compared with the fiscal year 1910.

[July 1, 1911.]

Division of the Bureau.	1910	1911	Decrease.	Increase.
General, inorganic and physical chemistry:				
Clays, soils, fertilizers, cements.....	P4,464.50	P5,309.50	-----	P845.00
Gases, petroleums, woods, fuels.....		540.00	-----	540.00
Waters.....	265.00	350.00	-----	85.00
Weights and measures, standardization.....	10.00	51.00	-----	41.00
Calorimetric tests of fuels.....		105.00	-----	105.00
Coal tests.....	95.00	35.00	P60.00	-----
Coal analyses.....	105.00	87.25	17.75	-----
Rocks and minerals.....	8.00	128.00	-----	120.00
Metals and alloys.....	17.50	233.00	-----	235.50
Tests of the compression, tensile, or transverse strength of concrete, stone, mortar, rope, iron, steel, etc.....		679.76	-----	679.76
Miscellaneous.....	710.75	830.50	-----	119.75
Total.....	5,675.75	8,369.01	-----	2,693.26
Organic chemistry:				
Foods, alcohols, beverages, etc.....	1,077.00	1,277.00	-----	200.00
Urines, clinical and toxicological, analyses, etc.....	163.00	356.00	-----	193.00
Oils, paints, pigments, etc.....	151.50	1,436.00	-----	1,284.50
Total.....	1,391.50	3,069.00	-----	1,677.50
Mines division: Assays.....	1,748.00	3,285.05	-----	1,537.05
Biological laboratory:				
Fæces.....	109.00	603.00	-----	494.00
Sputum.....	42.00	24.00	18.00	-----
Blood.....	12.00	187.00	-----	175.00
Gonococci.....	3.00	12.00	-----	9.00
Waters.....	470.00	70.00	400.00	-----
Necropsies.....			119.00	-----
Miscellaneous.....	190.00	71.00	-----	-----
Total.....	826.00	967.00	-----	141.00
Serum section of biological laboratory:				
Vaccine virus.....	31,072.85	31,764.27	-----	691.42
Antirinderpest serum, bottling, standardizing, etc. only.....	27,522.85	11,656.66	15,866.19	-----
Mallein.....	705.00	536.70	168.30	-----
Miscellaneous preparations.....	1,149.85	1,878.43	-----	728.58
Total.....	60,450.55	45,836.06	14,614.49	-----
Miscellaneous:				
Shop Work.....	115.93	206.92	-----	90.99
Photographic work.....	4,260.46	3,643.63	616.83	-----
Natural history specimens.....	23.00	261.22	-----	238.22
Miscellaneous work, etc.....	2,121.69	1,027.56	1,094.13	-----
Supplies.....	1,584.36	2,044.34	-----	459.98
Sale of documents.....	3,436.10	5,588.50	-----	2,152.40
Refunded, work not done, etc. (deducted).....	123.22	44.10	79.12	-----
Total.....	11,418.32	12,816.27	-----	1,397.95
Grand total.....	81,510.12	74,342.39	7,167.73	-----

TABLE IV.—*Showing free and cash work performed and supplies sold to the various Departments of the Government for the fiscal year 1911.*

Bureau or Department.	Number of samples or units.	Free.	Cash.	Total.
Bureau of Health:				
Foods, alcohols, beverages.....	711	₱8,401.00		
Fuels, gases, petroleums, woods				
Urinés, clinical and toxicological analyses, etc.	394	1,131.00	₱80.00	
Miscellaneous chemical analyses and examinations	13	150.00		
Waters:				
Chemical	35	500.00		
Biological	197	8,375.00		
Fæces	4,064	99,492.00	40.00	
Sputum	129	387.00		
Blood	217	782.00	39.00	
Gonococci	13,994	41,982.00	3.00	
Necropsies	211	5,275.00		
Miscellaneous biological work and examinations	5,756	21,345.42		
Vaccine virus	3,050,800		30,508.00	
Miscellaneous serums and preparations	315,821		569.15	
Photographic work	1,028		294.71	
Shop work	10		33.17	
Supplies			30.81	
Miscellaneous work	2		63.50	
Total		187,820.42	31,661.34	₱219,481.76
Bureau of Agriculture:				
Fertilizers, cements, clays, soils	8	240.00		
Fuels, woods, gases, petroleums				
Foods, alcohols, beverages	2	30.00		
Urinés, clinical and toxicological analyses, etc.				
Miscellaneous chemical work and examinations	9	50.00		
Waters, biological				
Miscellaneous biological work and examinations				
Antirinderpest sera (bottling, sterilizing, etc.) only	4,863,833		11,655.16	
Mallein	127		13.70	
Miscellaneous serums and preparations	245		245.00	
Photographic work	1,237		337.53	
Supplies	17		39.23	
Miscellaneous work				
Total		320.00	12,290.62	12,610.62
Bureau of Supply:				
Oils, paints, pigments, etc	28	337.00		
Fertilizers, cements, clays, soils				
Gases, petroleums, woods, fuels				
Metals and alloys	2	10.00		
Foods, alcohols, beverages	1	10.00		
Standardizations of weights and measures	1,041	520.50		
Miscellaneous chemical work and examinations	62	507.00		
Waters, biological	73	1,660.00		

TABLE IV.—*Showing free and cash work, etc.*—Continued.

Bureau or Department.	Number of samples or units.	Free.	Cash.	Total.
Bureau of Supply—Continued.				
Supplies				
Total		₱3,044.50		₱3,044.50
Bureau of Public Works:				
Oils, paints, pigments, etc				
Fertilizers, cements, clays, soils	2,510		₱2,510.00	
Miscellaneous chemical work and examina- tions	7	20.00	10.00	
Metals and alloys				
Waters:				
Chemical	43	665.00		
Biological	38	1,560.00		
Miscellaneous work				
Photographic work	50		10.00	
Supplies				
Total		2,245.00	2,530.00	4,775.00
Bureau of Prisons:				
Oils, paints, pigments, etc				
Fertilizers, cements, clays, soils				
Standardization of weights and measures				
Urines, clinical and toxicological analyses, etc	18	54.00		
Waters, biological	12	120.00		
Fæces	10,650	36,212.00		
Sputum	640	1,920.00		
Blood	62	180.00		
Necropsies	27	775.00		
Miscellaneous biological work and examina- tions				
Total		39,261.00		39,261.00
Bureau of Internal Revenue:				
Foods, alcohols, beverages	60	400.00	365.00	
Standardization of weights and measures				
Miscellaneous chemical work and examina- tions	32	80.00	5.00	
Total		480.00	370.00	850.00
Bureau of Printing:				
Miscellaneous chemical work and examina- tions	104	1,040.00		
Assays				
Total		1,040.00		1,040.00
Bureau of Customs:				
Oils, paints, pigments, etc	10	117.50		
Foods, alcohols, beverages	104	588.00		
Standardization of weights and measures				
Metals and alloys	19	45.00		
Miscellaneous chemical work and examina- tions	39	318.00		
Waters, biological				
Total		1,068.50		1,068.50

TABLE IV.—*Showing free and cash work, etc.*—Continued.

Bureau or Department.	Number of samples or units.	Free.	Cash.	Total.
Bureau of Science:				
Oils, paints, pigments, etc				
Fertilizers, cements, clays, soils	3	P50.00		
Fuels, woods, gases, petroleum				
Foods, alcohols, beverages	1	15.00		
Metals and alloys				
Urinis, clinical and toxicological analyses, etc	3	9.00		
Rocks and minerals	17	138.00		
Coal test	3	60.00		
Coal analyses	1	20.00		
Assays	18	101.00		
Miscellaneous chemical work and analyses	103	257.00		
Waters, biological	7	280.00		
Photographic work	9,955	2,182.76		
Shop work	194	2,374.28		
Miscellaneous	1			
Total		5,487.04		P5,487.04
Bureau of Justice:				
Miscellaneous chemical work and examina- tions	5		P135.00	135.00
Bureau of Forestry:				
Oils, paints, pigments, etc				
Photographic work	139		14.20	
Total			14.20	14.20
City of Manila:				
Fertilizers, cements, clays, soils	62		195.00	
Foods, alcohols, beverages	1		6.00	
Miscellaneous sera and preparations	41,300		46.00	
Mallein	16,002		18.00	
Photographic work	10		31.50	
Tests of the compression, tensile, or trans- verse strength of concrete, stone, mortar, rope, iron, steel, etc	10		40.00	
Miscellaneous biological				
Total			336.50	336.50
Provinces and municipalities:				
Vaccine virus	13,100		393.00	
Tests of the compression, tensile, or trans- verse strength of concrete, stone, mortar, rope, iron, steel, etc	13		17.26	
Miscellaneous work				
Weights and measures standardized	1		6.00	
Total			416.26	416.26
Public Health and Marine-Hospital:				
Fertilizers, cements, clays, soils				
Vaccine virus	6,700		67.00	
Miscellaneous work				
Total			67.00	67.00

TABLE IV.—*Showing free and cash work, etc.*—Continued.

Bureau or Department.	Number of samples or units	Free.	Cash.	Total.
Executive Bureau: Photographic work	1,719		P732.45	P732.45
Bureau of Audits: Assays	1	P28.00		28.00
College of Medicine and Surgery, University of the Philippines:				
Foods, alcohols, beverages	7	49.00		
Miscellaneous chemical work and examina- tions	10	5.00	23.00	
Miscellaneous sera	90		4.00	
Photographic work	242		120.10	
Shop work	3		14.07	
Miscellaneous work				
Supplies	120		399.15	
Total		54.00	560.32	614.32
United States Army and Navy:				
Oils, paints, pigments, etc.	65		1,184.00	
Fertilizers, cements, clays, soils	253		1,235.00	
Tests of the compression, tensile, or trans- verse strength of concrete, stone, mortar, rope, and steel, etc	48		130.00	
Coal, analyses				
Foods, alcohols, beverages	17		123.00	
Miscellaneous chemical	9		27.00	
Waters:				
Chemical	3		270.00	
Biological				
Vaccine virus	21,356		623.70	
Mallein	521		521.00	
Miscellaneous biological	1		10.00	
Miscellaneous serums and preparations	123,921		227.28	
Photographic work	12		3.60	
Miscellaneous work	1		10.00	
Supplies	6,930		10.20	
Total			4,374.78	4,374.78
Bureau of Education:				
Fertilizers, cements, clays, soils	2	90.00		
Miscellaneous chemical work and examina- tions	1	3.50		
Waters, biological				
Photographic work	717		278.00	
Supplies				
Total		93.50	278.00	371.50
Bureau of Constabulary:				
Miscellaneous chemical work and examina- tions	44	389.00		
Fæces	14	42.00		
Sputum	17	51.00		
Miscellaneous biological work and examina- tions				
Vaccine virus	3,200		32.00	
Supplies				
Total		482.00	32.00	514.00

TABLE IV.—*Showing free and cash work, etc.—Continued.*

Bureau or Department.	Number of samples or units.	Free.	Cash.	Total.
Bureau of Navigation:				
Oils, paints, pigments, etc				
Fertilizers, cements, clays, soils	140	P90.00	P190.00	
Foods, alcohols, beverages				
Miscellaneous chemical work and examinations	12	120.00		
Waters, biological	30	1,220.00		
Total		1,430.00	190.00	P1,620.00
Miscellaneous:				
Oils, paints, pigments, etc	24		252.00	
Fertilizers, cements, clays, soils	167		1,049.50	
Fuels, woods, gases, petroleums				
Foods, alcohols, beverages	155		753.00	
Urines, clinical and toxicological analyses	72		276.00	
Rocks and minerals	16		128.00	
Coal analyses	6		87.25	
Assays	1,504		3,285.05	
Standardization of weights and measures	4		36.00	
Miscellaneous chemical work and examinations	52		993.50	
Waters—				
Chemical	3		80.00	
Biological	3		70.00	
Fæces	183		573.00	
Sputum	11		21.00	
Blood	7		113.00	
Gonococci	2		9.00	
Miscellaneous biological work and examinations	4		27.00	
Vaccine virus	4,351		1,464.40	
Miscellaneous sera and preparations	273,582		748.90	
Photographic work	6,196		1,653.76	
Shop work	9		11.79	
Miscellaneous work, etc	28		869.06	
Supplies	399		1,958.89	
Sale of publications			5,588.50	
Natural history specimens	178		261.22	
Refunds, work not done, etc. (deductions)			44.10	
Power, gas, etc			13,848.79	
Total			34,202.71	34,202.71
Grand total		242,853.96	88,191.18	331,045.14

Note.—The value of free work is based on the rates as given in the official schedule of charges approved by the Honorable the Secretary of the Interior, and does not comprise amounts based on wholesale rates; this in accordance with Act 807, section 1, Bureau of Government Laboratories, last paragraph, July 1, 1910.

TABLE V.—Comparative statement showing expenditures (including obligations incurred) for the fiscal year 1911 as compared with the fiscal year 1910.

Item.	Expended during the year.	Outstanding obligations on July 1, 1911, incurred during the fiscal year.	Total for the fiscal year 1911.	Total for the fiscal year 1910.	Decrease.	Increase.
Apparatus, supplies, etc.:						
Miscellaneous supplies and chemicals						
Apparatus	\$13,517.29	\$4,141.19	\$17,658.48	\$20,131.86	\$2,473.38	
Supplies for power plant, oil, coal, etc	4,606.65	7,939.52	12,546.17	14,463.53	1,917.36	
Small animals, feed, etc	18,194.69	4,551.60	22,746.29	11,894.81		\$10,851.48
Large animals, feed, etc	7,648.11		7,648.11	1,897.42		5,750.69
Office supplies	6,038.16	212.96	6,251.12	6,822.91	571.79	
Photographic supplies	1,465.51	24.66	1,490.17	2,674.91	1,184.74	
Books, subscriptions, etc	2,703.37		2,703.37	3,016.12	312.75	
	3,654.91	6,562.44	10,217.35	2,340.89		7,876.46
Total	57,828.69	23,432.37	81,261.06	63,242.45		18,018.61
Transportation and freight, etc.:						
Transportation, travel expenses, per diems, launch hire, etc	12,068.67	440.00	12,508.67	11,870.51		638.16
Freight	736.97		736.97	600.12		136.85
City transportation	2,969.15		2,969.15	3,224.62	255.47	
Total	15,774.79	440.00	16,214.79	15,695.25		519.54
Miscellaneous:						
Telephones and fire alarm boxes	974.64		974.64	739.20		235.44
Postage, telegrams, and cablegrams	4,534.49		4,534.49	3,088.95		1,445.54
Repairs to apparatus, furniture, etc	428.02		428.02	983.95	555.93	
Laundry	365.04		365.04	599.91	234.87	
Printing and binding	21,139.68	9,204.70	30,344.38	31,078.73	734.35	
Advertising	1,202.84		1,202.84	3,194.45	1,991.61	
Incidentals, building maintenance, etc	7,505.85	620.11	8,125.96	2,599.60		5,526.36
Museum specimens	9,806.80		9,806.80	7,853.87		1,952.93
Total	45,957.36	9,824.81	55,782.17	50,138.66		5,643.51

Salaries and wages:

Salaries and wages	248,886.05	248,886.05	245,960.35	2,925.70
Transportation and expenses en route foreign country to Manila	2,697.52	2,697.52	6,123.39	3,425.87
Accrued leave and half salary	18,899.96	18,899.96	21,693.30	2,793.34
Total	270,483.53	270,483.53	273,777.04	3,293.51
Grand total	390,044.37	33,697.18	402,833.40	20,888.15

The outstanding obligations and accounts payable of previous fiscal years unpaid on July 1, 1910, amounted to ₱39,398.02. During the fiscal year 1911, ₱33,513.39 was paid against this amount and the difference between estimates and actual costs and cancellations amounted to ₱3,865.15, leaving the obligations still due on previous fiscal years, ₱2,519.48.

Transferred to Bureau of Public Works	33,513.39	2,519.48		35,774.88
Transferred to Aquarium	423,557.76	36,216.66		40,000.00
	3,529.41			88,191.18
	40,000.00			4,161.56
	467,087.17	36,216.66		512,250.76

Aquarium, Act 1902:

Available by transfer from Bureau of Health	40,000.00			
Expended	16,091.02			
Obligations	23,908.98			
Balance				

Reversion, fiscal year 1911	43,529.41	503,303.83
Library fund, Act 1416:		8,946.93
Available, July 1, 1910		2,909.00
Credits		309.75
Total available		3,218.75

Expended	₱3,056.97	
Obligations	114.10	3,171.07
Balance		47.68

Scientific investigation of animal diseases, Act 1955:

Available, July 1, 1910		4,081.33
Expended		3,304.47
Balance		776.86

Library stacks, etc., Act 1988:

Available, July 1, 1910	17,500.00			
Obligations	15,550.65			
Balance	1,949.35			



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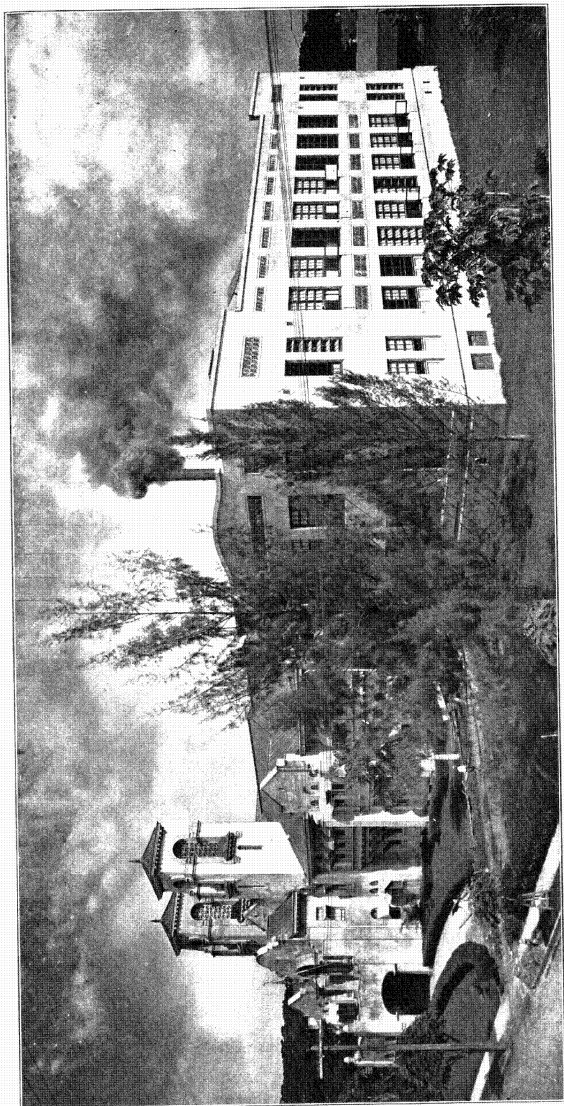


PLATE I. MAIN BUILDING, BUREAU OF SCIENCE.

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